UNIVERSITY OF NOVI SAD
TECHNICAL FACULTY
"MIHAJLO PUPIN"
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ITROCONFERENCE 7.0
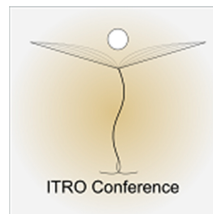## INFORMATION TECHNOLOGY AND EDUCATION DEVELOPMENT

PROCEEDINGS

ZRENJANIN, June 2016

UNIVERSITY OF NOVI SAD
TECHNICAL FACULTY "MIHAJLO PUPIN"
ZRENJANIN
REPUBLIC OF SERBIA

VII INTERNATIONAL CONFERENCE ON
INFORMATION TECHNOLOGY AND DEVELOPMENT OF EDUCATION ITRO 2016
PROCEEDINGS OF PAPERS

VII MEĐUNARODNA KONFERENCIJA
INFORMACIONE TEHNOLOGIJE I RAZVOJ OBRAZOVANJA ITRO 2016
ZBORNIK RADOVA

ZRENJANIN, JUNE 2016

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INTRODUCTION

This Proceedings of papers consists from full papers from the International conference "Information technology and development of education" - ITRO 2016, that was held at the Technical Faculty "Mihajlo Pupin" in Zrenjanin on June 10th 2016.

The International conference on Information technology and development of education has had a goal to contribute to the development of education in Serbia and the Region, as well as, to gather experts from natural and technical sciences' teaching fields.

The expected scientific-skilled analysis of the accomplishment in the field of the contemporary information and communication technologies, as well as analysis of state, needs and tendencies in education all around the world and in our country has been realized.

The authors and the participants of the Conference have dealt with the following thematic areas:

- Theoretical and methodological questions of contemporary pedagogy
- Personalization and learning styles
- Social networks and their influence on education
- Children security and safety on the Internet
- Curriculum of contemporary teaching
- Methodical questions of natural and technical sciences subject teaching
- Lifelong learning and teachers' professional training
- E-learning
- Education management
- Development and influence of IT on teaching
- Information communication infrastructure in teaching process

All submitted papers have been reviewed by at least two independent members of the Science Committee.

There were total of 163 authors that took part at the Conference from 15 countries, 4 continents: 96 from the Republic of Serbia and 67 from foreign countries such as: Macedonia, Bulgaria, Slovakia, Russia, Montenegro, Albania, Hungary, Italy, India, Rumania, Bosnia and Herzegovina, USA, Egypt and Nigeria. They were presented 82 scientific papers; 42 from Serbia and 40 from the above mentioned countries.

The papers presented at the Conference and published in Proceedings can be useful for teachers while learning and teaching in the fields of informatics, technics and other teaching subjects and activities. Contribution to the science and teaching development in this Region and wider has been achieved in this way.

The Organizing Committee of the Conference

CONTENTS

INVITED

LECTURES

Engineering Education in the Framework of European Qualification

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Abstract – The paper analyzed the influence of the the European Qualifications Framework for conducting reforms on engineering education, and the influence of these reforms on improve the quality of trained engineers, as well as increasing expectations to their qualification for solving the problems of the modern information society. Discussed are standards for engineering education and the requirements to achieve them, and the results of the harmonization of the European Qualifications Framework with the national framework of Bulgaria and university level. Defined are the main problems for effective reform of engineering education.

I. INTRODUCTION

Recent changes in education systems, as well as in the international macroeconomic context, lead to the need for increased demand for engineering professionals to strengthen engineering programs and to increase their transparency. In this context, the profession of engineer becomes increasingly important degree of influence on the results of work on the development of the economy and the fate of the planet and humanity. As early as 1906, GG Prout told Cornell Association of Civil Engineers that: «Engineers, above all, will lead humanity forward ... before engineers ... lies such responsibility that mankind has never encountered» [7].

Studying the experience of other countries concludes that today the education, particularly engineering education is in crisis. The reasons can be defined as: inadequate funding, lack of motivation among young people, functional illiteracy (inability to perform the functions regardless of the acquired education); uncertainty the aims of the training, insufficient understanding of the public role of engineering education, its importance for social progress, etc.

This paper is an attempt to assess the role of the documents adopted by the European Commission to carry out reforms on engineering education. To analyze the impact of these reforms to improve the quality of trained engineers, raising expectations for

their qualification. To define the main problems in the training of engineers in Southwestern University, Bulgaria and identify ways of solving problems.

EUROPEAN AND NATIONAL QUALIFICATION FRAMES

In the late nineties 29 European countries signed the "Bologna Declaration" [2] aiming to adopt an approach for easy comparison of qualification degrees in different countries. Currently the declaration is support by the 47 countries and include reforms in the following areas:

✓ Creating a common framework of qualifications, including three cycles of higher education (bachelor, master, doctorate);

✓ strengthening and improvement of joint degree programs;

✓ facilitate the mobility of teaching and professorial staff, students and graduates;

✓ Recognition of qualifications in the different education systems and countries;

✓ Improving the quality in higher education (quality assurance);

✓ Providing equal opportunities to students in higher education sphere;

✓ Encourage life-long studying.

The result is a developed European Qualification Frame (EQF), which establishes links between national qualifications systems of Member States, as well as promotes citizens' mobility between countries and facilitates their learning throughout life.

The incorporation of national qualifications frameworks in different countries around a common European Qualifications Framework is implement through eight reference levels. The levels span the full range of qualifications - from basic (Level 1,

certificates of grade or stage of school education, for example) to advanced (Level 8, educational and scientific degree Doctor). The structure of the European and national qualifications frameworks is hierarchical and is present in figure1.
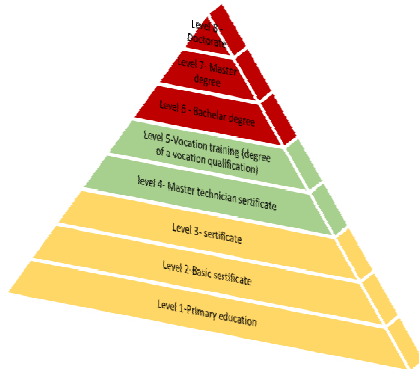
Figure1. Hierarchical structure of the reference levels of EQF

The reference levels determine the specifics of the educational systems of each member state. The reference levels for Bulgaria represented in Figure 2.

EQF	Bulgarian QF	NQF
8	Doctoral degree	8
	Continuing training	
7	Master degree	7
	Continuing training	
6	Bachelor degree	6
	Degree of "professional bachelor in.."	
	Continuing training	
5	Vocation training (degree of a vocation qualification)	5
4	Upper secondary education school leaving certificate general/vocational education and training (degree of a vocational qualification)	4
3	Lower secondary education certificate general/vocational education and training (degree of a vocational qualification)	3
2	Basic educational certificate (five to eight class) general/vocational education and training (degree of a vocational qualification)	2
1	Primary education certificate	1
N/A	Pre-primary education	0

Figure 2. Bulgarian NQF

Within the EQF, a learning outcome is define as an indicator of what a learner knows, understands and is able to do on completion of a learning process. Therefore, EQF focuses on learning outcomes rather than on inputs such as length. Figure 3 illustrates in an abstract way the existing complexity of national frameworks and systems. Cooperation based on bilateral or multilateral contacts between frameworks and systems between countries would be extremely difficult and would severely limit transparency, transfer and recognition of qualifications. Figure 3 illustrates how the relationship between different national frameworks and systems can simplified by introducing common reference levels and common principles for cooperation.
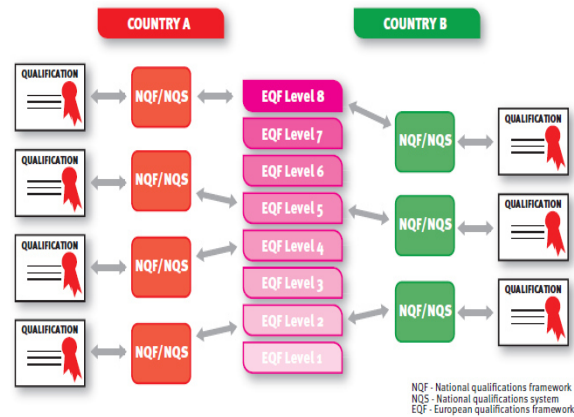
Figure 3. Relation between the levels of different national qualifications systems to the EQF

According EQF adopted in the European area of higher education learning outcomes are define as a combination of:

- **Knowledge** (K) being described as theoretical and / or factual;

- **Skills** (S), as are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and use of methods, materials, tools and instruments);

- **Competence (C)**, described in terms of responsibility and autonomy.

II.   ENGINEERING EDUCATION IN THE EUROPEAN QUALIFCATION FRAME

Levels 6th to 8th designed for qualifications in higher education - educational degrees "Bachelor", "Professional Bachelor" and "Master" and the educational and scientific degree "Doctor". All these levels based on a results-oriented learning approach and described in **Knowledge** (theoretical and/or factual), **Skills** (cognitive and practical) and **Competences** (personal and professional).

- *Reform of the Engineering education*

The need for reform of engineering education is realize at the end of last century. At the beginning of the 21st century, a huge international project began work with the primary task of reforming engineering education, including participants from over 40 countries and all continents. This project is called CDIO (Conceive - Design - Implement - Operate) [1]. Twelve standard for engineering education programs CDIO is the result of the project were developed and adopted. These standards developed with the assistance of heads of educational programs, graduates of universities, partners and users of personnel.

From the proposed standards, it became clear what the goals and objectives the universities should put to achieve social and professional recognition of their production of engineers in the world. The standards developed for designing of engineering programs and degrees and the valuation based on the same learning outcomes (objectives) of the approach used by the EQF. The content of the standards presented in Table1.

TABLE 1. STANDARTS CDIO

Standard 1	Describes the general philosophy of the engineering program.
Standards 2, 3, 4	Curriculum development
Standards 5 and 6	Development of practical tasks and design of teaching facilities for the classes in engineering
Standards 7 and 8	New methods of teaching and training
Standards 9 and 10	Improvement of faculty qualification
Standards 11 and 12	Appraisal of the programs and students' progress

In a UNESCO report on engineering education found a discrepancy between the content and results of engineering educational programs regarding level of development modern technologies and expectations of employers [6]. A solution to solving the problem is proposed by developing new approaches to engineering education "at the expense of strengthening practical training, introducing a system for problem training, reflecting the essence of the profession of engineer - to solve problems» [3].

The principle of CDIO for engineering includes support to the engineering product of his creation throughout its whole life cycle: Conceive - Design - Implement-Operate.

CDIO creates an environment for engineering education. In this environment teaching, acquire and apply in practice knowledge and skills. Such an approach is successful only when the principles of CDIO are shared and applied by professors and teaching staff.

Reform of engineering education according to the principles of the CDIO project provides novice engineers with the ability to "Invent - Design - Apply - Manage», complex products and systems in today's teamwork. During the training students need to learn to manage engineering processes to design, create products and apply their learning to work in industrial conditions. This is the essence of the engineering profession. In the curriculum, learning outcomes classified into four categories (Table. 2).

TABLE 2. THE LEARNING OUTCOMESS BY CDIO

1. TECHNICAL KNOWLEDGE AND REASONING
1.1 knowledge of underlying science
1.2 core engineering fundamental knowledge
1.3 advanced engineering fundamental knowledge
2. PERSONAL AND PROFESSIONAL SKILLS AND ATTRIBUTES
2.1 engineering reasoning and problem solving
2.2 experimentation and knowledge Discovery
2.3 system thinking
2.4 personal skills and attitudes
2.5 professional skills and attitude
3. INTERPERSONAL SKILLS: TEAMWORK AND COMMUNICATION
3.1 multi-disciplinary teamwork
3.2 communications
3.3 communications in foreign languages
4. CONCEIVING, DESIGNING, IMPLEMENTING, AND OPERATING SYSTEMS IN THE ENTERPRISE AND SOCIETAL CONTEXT
4.1 external and societal context
4.2 enterprise and business context
4.3 conceiving and engineering systems
4.4 designing
4.5 implementing
4.6 operating

Knowledge and skills are determined in accordance with Table 3.

TABLE 3. KNOWLEGE, SKILLS AND COMPETENCE FOR ENGINEERIN
EDUCATION BY CDIO

EQF Level	EQF Verbs (and Verb Phrases)	Bloom & al. Verbs	CDIO Level
8	Skills: **Synthesize, Evaluate, Solve, Innovate, Extend and Redefine Knowledge** Competence: Demonstrate, **Develop new ideas and processes**	Synthesize (5), Evaluate (5), Solve (4), Create (5), Improve (5), Compose (5)	5
7	Knowledge: Original thinking, **critical awareness** Skills: Problem **solving**, Innovate, **Develop**, Integrate Competence: **Manage, Transform, Reviewing Performance**	Critique (5), Solve (4), Formulate (5), Manage (5), Modify (4), Appraise (4)	4-5
6	Knowledge: Critical **understanding** Skills: **Innovate**, Solve Competence: **Manage, Decision Making**	Comprehend (3), Devise (5), Solve (4), Manage (5), Select (4)	4

III. STANDARDS FOR ENGINEERING EDUCATION

Standards of engineering education developed and controlled by European professional organizations such as:

- FEANI (European Federation of National Engineering Associations). The FEANI scheme is an excellent example of self-regulation by a profession at European level and it provides a model for other professional groups. The FEANI register recognizes and builds upon the diversity of forms of engineering education that exist in the Community and can adapt to any changes, which can decided upon at national level. The procedures for dealing with applications for registration also provide a good respective expertise. Registration on the FEANI register indicates that, whatever the duration or content of his or her initial training, the engineer has reached a certain level of professional competence, certified by his or her peers both at national and European level [9].

- EUR ING (European Accredited Engineer)-European Engineer (EUR ING, Eur Ing, or Eur-Ing.) is an international professional qualification for engineers used in over 32 European countries.[] The title is granted after successful application to a national member of the European Federation of National Engineering Associations (FEANI) which includes representation from many European countries, including much of the European Union. It allows a person who has an engineering degree and usually an engineering professional qualification in one of the member countries to use the qualification in others, but this depends on local legislation [10].

- The recognition of engineering education by FEANI and EUR ING based on certain requirements, including a minimum of seven years of education, training and experience. This period shall differentiated on: minimum three years successfully completed engineering education in university (U) or another recognized organization of FEANI (according to FEANI Index) and minimum two years of valid professional experience (E). When education and experience together are less than the minimum seven years the balance of seven years is required to cover: education (U), experience (E), or training (T), which has been committed in the approved engineering institutions, or by preliminary engineering professional experience.

- In document EUR-ACE A1-en FINAL Approved by Project Board the objectives; in particular the final results of the training of the European engineers are set.[2] According to these standards, to obtain an engineering degree the students must meet six basic criteria that correspond to Bachelor and Master degree

  - Knowledge and understanding;

  - Engineering analysis;

  - Engineering design;

  - Research;

  - Engineering practice;

  - Professional and personal skills.

- Although all six criteria apply to both cycles, there are important differences in the requirements for the two degrees - Bachelor and Master [2].

IV. HARMONIZATION WITH THE EUROPEAN LEGISLATION IN THE SPHERE OF QUALIFICATIONS

A. At the national level.

At present, the adaptation to European processes of validation of knowledge and successful adaptation to the policies and processes of the European Union to help employers interpret the qualifications of applicants and promoting mobility in the labor market can defined as successful. An "Information system for competence assessment" - Competence, is already a fact in Bulgaria. The new information system is to support not only the employers and job- and qualification-seekers, but also the universities in developing documentation

for training in accordance with the European Qualifications Framework [4].

B. At the University level

- Developed are curricula for the three educational degrees: Bachelor, Master and Doctor with included opinion of the employers and requirements of the industrial organizations and ESTC;

- All curricula include the basic components that describe the requirements of the qualification – knowledge, skills and competence as well as the results of the students' evaluations and examination procedures; their contents reflects the opinion of the students of previous classes and employers, too;

- Developed are training courses, electronic textbooks, teaching aids and tests for online training, self-preparation and examination of knowledge of students;

- Developed and applied is a system for management of the quality assurance of the teaching process that include an annual survey of the opinion of students, graduates, employers of alumni in every program, as well as planned and ad hoc audits in the departments of the Southwest University;

- There is an activated system for exchange of good practices and mobility of students and faculty from the universities that participate in the Erasmus + Program;

- There is an activated system for the validation of the completed higher education, of completed educational periods of education in Bulgarian and foreign universities, based on ESTC.

V.   Problems of Modern Engineering
Education in the Context of the EQF

- Funding of higher education – enough to maintain the life minimum of the educational process;

- Resource provision of the educational process - at a low level relying on donations, equipment projects, no economic independence of the units at the university;

- Characteristics of the education - There is no balance between the main components of the training - theoretical, applied, practical, economic, managerial, personality building and general education;

- No requirements for professorship teaching staff for their teaching qualifications, e.g. knowledge of foreign languages, programming, education, psychology, mathematics, etc;

- There is no clear requirements for writing textbooks and other teaching aids;

- Students - Some of them are not sufficiently motivated; do not attend regular classes; study and work; have no connection with teachers; inadequate training in foreign languages; no interest in the quality of education;

- Small number of participants in Erasmus+ - language barrier and small grandees;

- Student applicants- issue with the applicants' coningent; lower control at admission; serious demographic collapse;

- Secondary education – worsening preparation in high schools;

- Business is not interested to invest in education, wants fully trained engineers, there is no legal relief

- Research, there are not enough good conditions for serious scientific work; financing of research is carried out only through projects and European projects in most cases require financing, which is impossible in most cases for universities.

VI.   Conclusion

EQF complements existing European mobility instruments, including Erasmus +, and ESTC in higher education;

- ECF allows Member States to validate the results of the study in different countries, thereby reducing the barriers between organizations providing services in the field of education and training, as well as validation of formal and informal learning;

- The area of European higher education in Engineering is not yet uniform and fully harmonized;

- There are differences between the member states for the meaning of the term "engineer", for the requirements for its preparation, and for the recognition of the qualification of the "engineer";

- We need to consolidate the efforts of universities from neighboring countries and

starting efficiency modernization of engineering education on common rules and documentation in accordance with the adopted model CDIO. The model will enable for efficient mobility of students and teachers;

- It is necessary to create and collaborative master's program;

- There is a need to promote cooperation between industry and engineering universities, between universities from different countries coordinate their programs.

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Welcome to the future (of teaching IT)

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Abstract – IT technology significantly advanced in past decade. The advance brings whole new concepts, ideas and approaches in utilization of new technologies. New technologies appeared very frequently and all these facts made number of challenges for the IT related curricula at university institutions. This paper gives short retrospective of varieties of teaching environments used for IT curricula, mainly related for teaching Computer Networks and Communication Systems courses.

The focus in this paper is on presenting the approach in tackling this challenge by introducing laboratories based on open-source hardware and single board computers in university curricula. The examples of usage of these sets are given in this paper. Together with the proposal of new platforms for teaching IT, the short analyses of possible usage of proposed environments in courses other than Computer Networks and Communication Systems is given at the end of this paper. The components of future IT curricula labs are proposed in order to adopt the strategy for efficient training of skilled IT professionals.

I. INTRODUCTION

This paper deals with the challenges of the transformation of university curricula caused by the appearance of new technologies in past decade. The development and market penetration of new technologies is dynamic and it causes the appearance of new concepts, ideas and approaches in utilization of IT technologies. All these reasons resulted with the need for large number of skilled software developers as well as for shaping the new developer profiles.

This paper is organized as follows. After the introduction, the changes in the modern ICT world are presented (Section II). These changes are illustrated with three major domains. First, the expansion of the Internet and growth of the Internet users are presented. The idea of IoT (Internet of Things) is explained in this section together with the analyses and prediction of changes that will come with the IoT expansion. IoT and related technologies are presented, as well as recent technology trends in the world.

After this section, the short overview of environments used for teaching IT courses mainly related with Computer Networks and Communication Systems are presented (Section III).

Section IV gives the introduction of the open-source hardware movement and its principles. Some types of open-source hardware and single board computers are presented. Also, the examples of usage of open-source hardware platforms for teaching, lecturing and student projects are given.

At the end (Section V), final analyses about possible additional usage of such lab platforms are given. Conclusion and further work is presented at the end.

II. ICT TECHNOLOGY CHANGES

The idea of this section is to briefly summarize the expansion of ICT technologies. This expansion can be illustrated with the rapid growth of Internet users, with the presentation of emerging and modern technologies and projected expansion of Internet of Things (IoT) [1]. The growth of Internet users is presented in Table I according to the World Internet statistic by Miniwatts Marketing Group [2]. Table presents the number of Internet users by continents. The most important data in following columns are continent population estimates for 2015, Internet users until November 30 2015, percentage of Internet users comparing to total population of the continent and growth from 2000 to 2015. Finally, the total numbers show that until November 30 2015, there were 3,366,261,156 Internet user, making 46.4 % of world population. Number of Internet users rose from 2000 by 832.5%.

TABLE I. WORLD INTERNET USAGE AND POPULATION STATISTICS, NOVEMBER 30, 2015 - UPDATE

World Regions	Population (2015 Est.)	Population % of World	Internet Users 30 Nov 2015	Penetration (% Population)	Growth 2000-2015	Users% of table
Africa	1,158,355,663	16.0 %	**330,965,359**	28.6 %	7,231.3%	9.8 %
Asia	4,032,466,882	55.5 %	**1,622,084,293**	40.2 %	1,319.1%	48.2 %
Europe	821,555,904	11.3 %	**604,147,280**	73.5 %	474.9%	18.0 %
Middle East	236,137,235	3.3 %	**123,172,132**	52.2 %	3,649.8%	3.7 %
North America	357,178,284	4.9 %	**313,867,363**	87.9 %	190.4%	9.3 %
Latin America/ Caribbean	617,049,712	8.5 %	**344,824,199**	55.9 %	1,808.4%	10.2 %
Oceania / Australia	37,158,563	0.5 %	**27,200,530**	73.2 %	256.9%	0.8 %
WORLD TOTAL	**7,259,902,243**	100.0 %	**3,366,261,156**	46.4 %	832.5%	100.0 %

The growth of Internet users has been massive but small in comparison with the projection of growth of connected devices given by Cisco Inc.,

and Gartner [3, 4, 5]. According to this estimation, the total number of connected devices will grow up to 50 billion by 2020. The projected growth in number of connected devices is presented in Fig. 1. In 2003, the world population was 6.3 billion and around 500 million of connected devices, making 0.08 connected devices per one inhabitant of the planet. Around 2007, the number of devices equalized with the number of inhabitants. By 2020 the estimated population of the world will be 7.6 billion; number of connected devices is estimated to 50 billion; making 6.58 devices per person. [3]
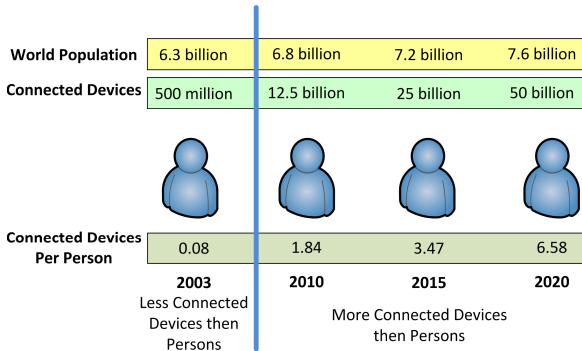
Figure 1.   Growth of IoT devices by 2020

The next figure (Fig. 2) gives estimation of devices growth in percentage from 2014 to 2019; and estimation in number of devices deployed in three sectors such as: home, government/ infrastructure and enterprise.
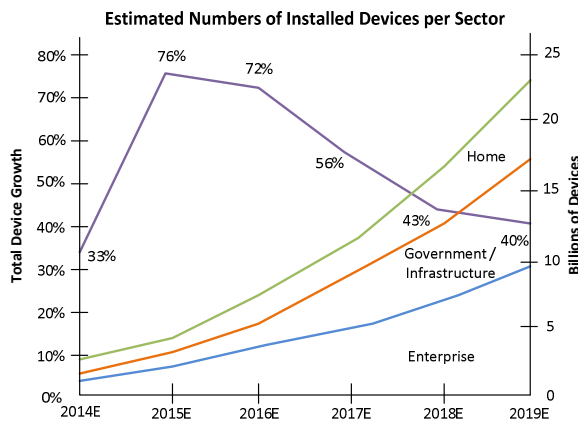
Figure 2.   Estimated growth of IoT devices per sector [2,3]

The last part of this section will present briefly the emerging technologies that appeared in past decade. The number of modern technologies can be summarized as follows: mobile technologies and mobile media (tablets, handheld devices, smartphones, other mobile devices), cloud computing (platform for variety of online services), Big Data (power data analytics), NoSQL databases, programming (Python, JSON, MQTT, Ruby,

Node.js, etc.), robotics, IPv6 and Mobile IPv6, 3D printing (rapid prototyping), wireless communication technologies (Wi-Fi [6], ZigBee [7], Z-Wave, 6LoWPAN [8], WirelessHart [9], Bluetooth Low Energy, NFC, RFID [10], LoRa, LoRa WAN, …), Machines to machines (M2M), smart technologies (smart city, smart agriculture, smart grid, etc.), Internet of Things [1], etc.

For this paper and its further content, the most important enlisted technologies are wireless communication technologies (particularly ZigBee, Bluetooth Low Energy, and RFID) and Internet of Things (IoT) [11]. Internet of Things (IoT) is the network of physical objects. These objects can be: electronic devices, vehicles, buildings and other items. Those objects are embedded with electronics, software, sensors, and network connectivity for transferring and exchange of collected.

When IoT is strengthened with sensors and actuators, the technology becomes foundation for more sophisticated systems which gives broad range of appliances as smart grids, smart homes, intelligent transportation, smart cities, etc.

According to the upper mentioned forecast of world-wide market leaders (Cisco Inc.) and analytics companies (Gartner) by 2020 number of the Internet-connected things will reach or exceed 50 billion. This number covers various types of devices such as: smart phones, tablets, desktops, laptops, sensors, vehicles and other embedded systems implemented in various objects. Furthermore, prognosis says that by 2020, 250 million vehicles will be connected to the Internet. In year 2014, global market for wearable devices was raised by 223%. Further, 27 million of M2M (Machine-to-Machine) connections is projected by 2024. The economic estimation is that IoT (Internet of Things) will add $15 trillion to Global GDP in next 20 years according to the prognosis.

All this will result with the need of 4.5 million of software developers trained for the new technologies and for IoT and WSN (Wireless Sensor Network) systems [12, 13]. So, the goal of this research is to tackle this challenge and to build a lab to support application development for IoT environments. With carefully analyses and technology research we will be able to face this challenge and to make adequate response.

III.   Laboratories for teaching Computer Networks and Communication Systems

In this section, teaching laboratories and platforms mainly focused on teaching Computer Networks and Communication Systems will be

presented very briefly. Those platforms can be divided in four major groups:

- software platforms,
- virtual network laboratories,
- physical network laboratories and
- combined network laboratories.

Software platforms can be described as network simulation and emulation software. There is variety of commercial and open-sources software useful for teaching computer networks and communication systems such as: Riverbed Modeler, OMNet++, Network Simulator (NS2 and NS3), GNS3, Matlab and many others.

Virtual network laboratories can be considered as a part of software platforms. Considering the variety of such laboratories and their wide presence in the world, here they are listed as separate category. Virtual laboratories can be explained as a virtual networks created using network devices and server/workstation emulations. These emulations are based on virtualization technology [14]. The large number of virtual network laboratories and network simulation environments exists. The most famous representatives are: Cloonix, Core, Imunes, Marionnet, Mininet, Netkit, Unified Networking Lab (UNL or UNetLab), VNX and VNUML, VNLab, etc [15, 16, 17, 18, 19, 20, 21].

The alternative to those two groups are real or physical network laboratories based on real network equipment [22]. Both software and hardware based laboratories has its advantages and disadvantages. The hardware based labs give better hands-on-lab experience, but software based labs offer lower-cost environments, faster and easier changes of labs with adoption of emerging technologies and availability to larger number of students.

Considering the advantages of both hardware and software labs, there is explanation for existence of fourth category – combined hardware and software labs. Those labs consists of both hardware and software parts and can be powerful and efficient environments.

The recent changes in ICT world, especially considering the expansion of IoT, WSN (Wireless Sensor Networks) and Smart technologies, gives serious question – are enlisted four types of labs suitable for tackling the challenge of introducing the IoT based laboratory scenarios in teaching curricula. The answer to the question is NO. The existing labs should be upgraded with the equipment capable to support new technology. The answer is clear, but what should be the solution? The solution can be introduction of open-source hardware and single board computers in university curricula.

The possible strategy for introducing those elements, their efficiency and suitability will be discussed in next sections.

IV. OPEN-SOURCE HARDWARE BASED LABORATORIES

Open-source hardware facilitates IoT application and system development. Open-source hardware consists of physical technological artifacts designed by the open design movement. [23, 24, 25]

Both free and open-source software together with open-source hardware is created by this open-source culture movement and applies this concept to a variety of components.

The term open-source hardware may be a little bit strange, but it is used for the principle that information about the hardware is open to others so the interested users can make it easily. It makes this movement very close to the maker movement. All important information such as: hardware design (mechanical drawings, schematics, bills of material, PCB layout data, HDL source code and integrated circuit layout data), as well as software that drives the hardware, are all released under free terms.

A. Usage of Arduino/Genuino based boards

One of the most popular open-source hardware platforms in the world are Arduino/Genuino based platforms [26, 27, 28, 29, 30]. Arduino/Genuino is widely spread in the world, not only because of the number of its copies sold in the world, but according to the number clone boards sold.

The number of sold clone board hugely overheads the number of original Arduino/Genuino boards. Arduino/Genuino is microcontroller board manufactured in many variations such as: Arduino UNO Rev3, Arduino Mega, Arduino Due, Arduino Leonardo, Arduino Mini, Arduino Nano, Arduino Yun, Arduino 101, etc. The detailed Arduino/Genuino board specification can be found on [29], and Arduino/Genuino UNO Rev3 board pinout is given in Fig. 3.
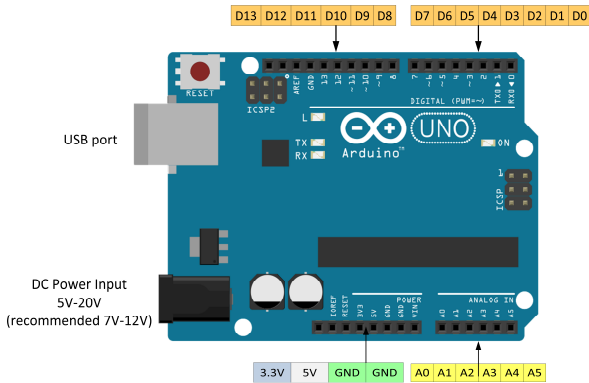
Figure 3.   Arduino/Genuino UNO Rev3 pinout

In Fig. 4 wiring scheme [31] for the sensor station based on Arduino/Genuino UNO Rev3 is given. This composition is used as one of the lab exercises in Technical Faculty "Mihajlo Pupin" (Zrenjanin, Serbia) curricula for Advanced Communication course, in order to illustrate wireless sensor technologies. The sensor station shown in the figure besides Arduino/Genuino UNO Rev3 board uses DHT11 temperature sensor and ultrasonic distance sensor.
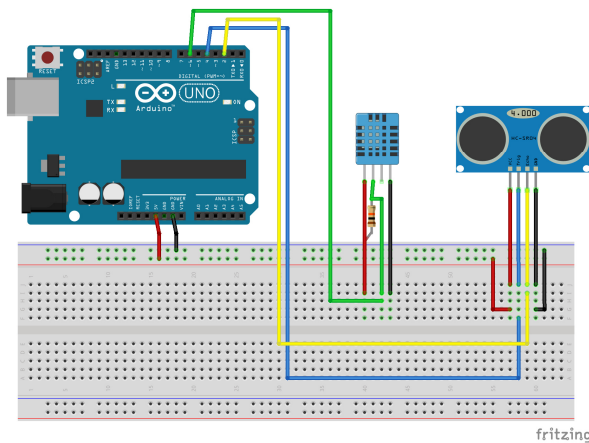
Figure 4.   Wiring scheme for DHT11 temeprature and ultrasonic distance sensor station Arduino/Genuino lab exercize (image is made in Fritzing available at http://www.frtizing.org)

B.   Usage of Texas Insturment Launchpad based development boards

In Fig. 5 is presented similar lab exercise platform deployed during the experimental usage in the same institution for the same course. The platform is based on MSP-EXP430G2 [35, 36]. The goal of the exercise is again to explain the functions of sensor node and to illustrate is programming.
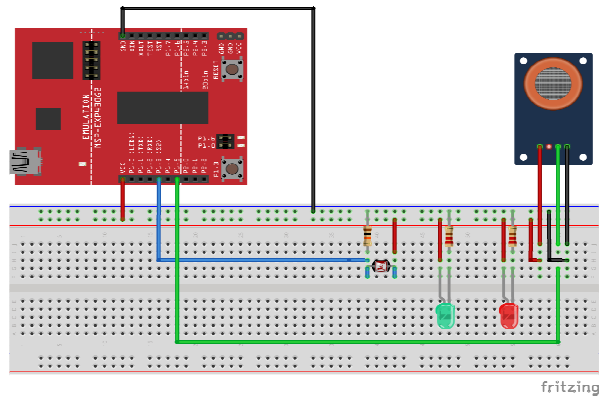
Figure 5.   Wiring scheme for Gas and light sensor station Texas instruments TI EX-MSP430G2 lab exercize (image is made in Fritzing available at http://www.frtizing.org)

The usage of Arduino/Genuino UNO Rev 3 and TI Launchpad such as MSP-EXP430G2 or MSP-EXP432P401R Launchpad [37, 38] can be similar because they can use similar IDEs. Arduino/Genuino uses Arduino IDE as its primary programming environment and TI Launchpad can use Energia (software very similar to Arduino IDE) but also the more powerful environments such as Code Composer Studio

C.   Usage of Arduino Yún based boards

Following example is based on Arduino Yún. It is not microcontroller board, but more powerful single-board computer. In Fig. 6 is given its image with its major port description. Arduino Yún is not microcontroller board, but more powerful single-board computer. Its operating system is based on OpenWRT-Yun version, adding to these small and affordable board capabilities of Linux server. More information about the platform specification is given in [32].
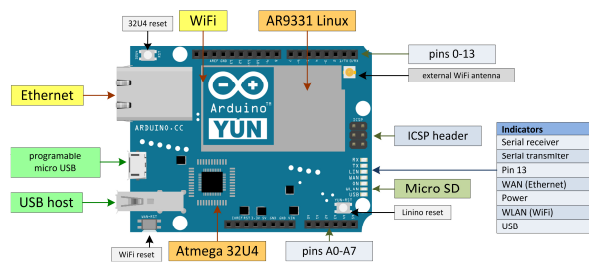
Figure 6.   Arduino Yun pinout [21]

This platform is used not for teaching but for student's project work according to Malić et al. [32]. In Fig. 7 wiring scheme for connecting USB camera is presented, together with PIR (motion detection) sensor. The system is used for creation of wireless surveillance video system in IoT environment.
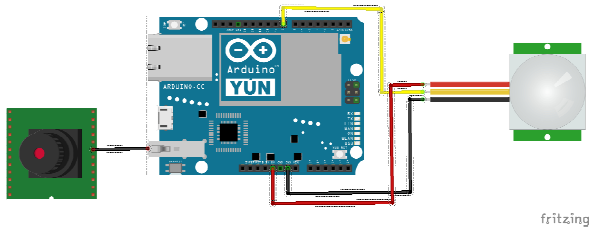
Figure 7. Wiring scheme for wireless video surveillance system Arduino Yun based student project (image is made in Fritzing available at http://www.frtizing.org) [21]

The position of Arduino Yún based board in IoT system is presented in Fig. 8. More details of the system and its functions can be found in [32].

D. Usage of Raspberry Pi 2 B+ based boards

The following example is used in academic research in order to evaluate the value of Raspberry Pi 2 B+ platform in teaching IoT. The Raspberry Pi 2 B+ is used for this research together with the Sense HAT. It is another very popular single computer board, with the support for Linux OS – Raspbian and several similar Linux operating systems, and for Windows 10 IoT edition.
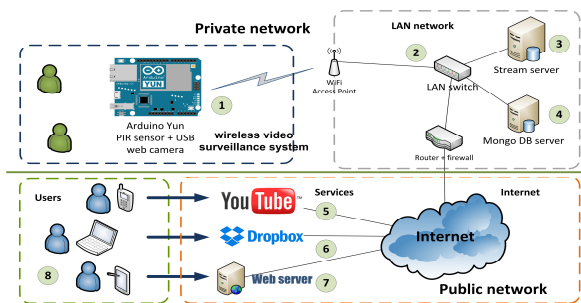
Figure 8. Wireless video surveillance system design for Arduino Yun based student project [32]

More details about the Raspberry Pi and other single computer boards, as well as about the research and teaching environment can be found in [33, 34]. The placement of the Raspberry Pi 2 B+ and Sense HAT in IoT environment is presented in Fig. 9. The position of each component of proposed platform is explained and justified with the IoT architecture and its layers [39].
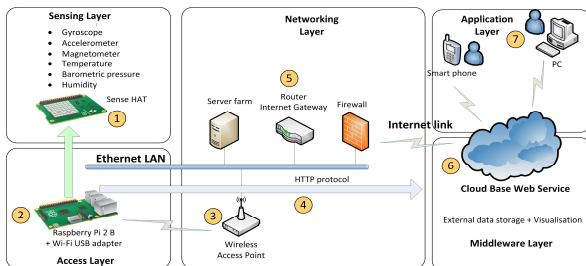
Figure 9. Example of Raspberry Pi2 B+ and SenseHAT for bulding IoT environment to be used in curricula

E. Examples of communication modules usage

Last subsection deals with the different scenarios and laboratory sets used mainly for student projects and student seminars or final works. The first scenario (Fig. 10) shows usage Arduino/Genuino UNO Rev3 in combination with XBee ZigBee modules [40, 41], for creating environment for development of temperature monitoring application [40, 42].

The open-source hardware is here used for low-cost, easily configurable and easy to assemble platform. The platform has enabled students to have the real time system in order to easily develop the application. [42]

Next scenario and laboratory set (Fig. 11) is built with the same purpose as previous. The novelty is usage of three types of wireless modules (ZigBee, IEEE 802.15.5, and RFID) for creating environment for development of application for RFID based tracking of the human resources [42, 43].
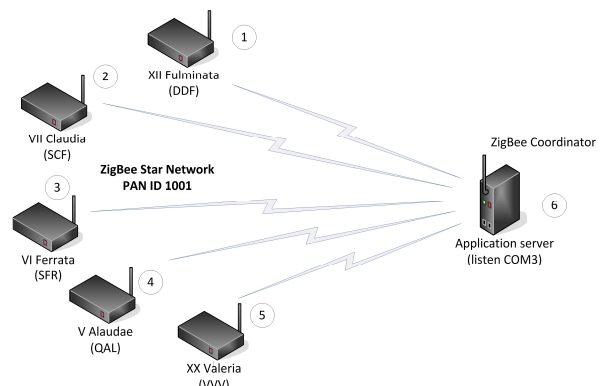
Figure 10. ZigBee scenario for temperature monitoring

The elements on Fig. 11 represents: RFID/ZigBee real platform (1), software emulated RFID/ZigBee platform #1 (2), software emulated RFID/ZigBee platform #1 (3) and application server (4).
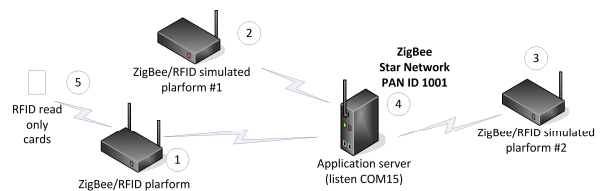
Figure 11. RFID/ZigBee scenario for tracking human resources

The last of three scenarios [42] is presented in Fig.12. Scenario represents the environment for application development for smart agriculture or smart farming applications. It was used in the same way as two previous platforms. The main idea is to connect one distant WSN network, e.g. located on a farm or agricultural area and transfer collected data using long-range technology to the data center and application server. The short range components as

sensor nodes (2), (3) and (4) can use Bluetooth Low Energy, ZigBee, IEEE 802.15.4a and RF proprietary protocols. Long-range gateway (1) can use any of above mentioned short-range technology and long-range module for connecting to the distant application server (5). Potential usage of GPRS, LoRa, RF proprietary protocols and WiFi can be considered.
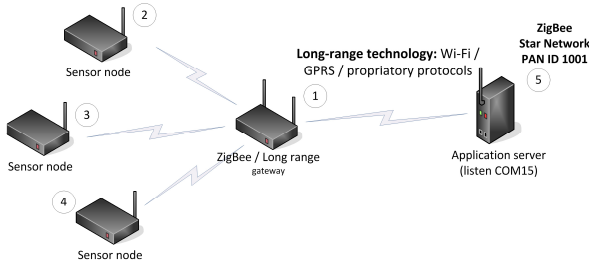
Figure 12. Smart agriculture or pollution monitoring scenario

V. RESEARCH SUMMARY

The presented networking scenarios used in teaching and lecturing Computer Networks, Communication systems and related courses and for building student project, proved to be very efficient for that purpose. The positive research results give the space for definition of components of future IoT oriented labs. These labs should consist of:

- Single board Computers (BeagleBone, Raspberry Pi, Arduino Yun, Intel Galileo / Edison, etc.),

- Open-source hardware microcontroller development boards – Arduino/Genuino, Texas Instruments Launchpad, Photon Particle, etc.)

- Expansion modules for both platforms, allowing easy to assemble, solderless platforms and configuration changes (such as Arduino shields, RPBi HATs and BeagleBone CAPEs), and

- Sensors and actuators to complete the creation of IoT and WSN environments.

Software supporting IoT lab sets should be:

- classical integrated development environments IDEs and

- cloud based IDEs – Photon Particle, Texas Instruments Code Composer Studio for Cloud, etc.

Considering that platforms are low cost, widely available for usage and purchasing, and very interesting to work with, it may be very attractive not only for teachers and students, but for much wider population like hobbyists and pupils. Further

analyses of platforms leads to the conclusion that open-source hardware platforms are applicable to:

- Universities: research; teaching; student labs; student project, bachelor, master and doctoral thesis.

- High schools: sections, teaching and talented pupils work,

- Primary schools: sections, teaching and talented pupils work

Considering of the complexity of supported environments proposed platforms are suitable for teaching following skills:

- Programming, Embedded programming, Network programming

- Emerging communication technologies: Wi-Fi, ZigBee, Bluetooth Low energy etc.

- Networking basics (routing, IP addressing, application and transport layer protocols) and advanced topics

- Linux and Windows OS basics

- Big Data, Cloud, mobile application development, etc.

All this promotes open-source hardware and single board computers to very efficient platform to be used for a given task – the task of modernization and transformation of laboratory sets to cover emerging technologies and trends, now and in near future.

VI. CONCLUSION AND FURTHER WORK

This paper presents the proposal for changing and enhancing the existing teaching facilities in university IT curricula. The proposed approach is defined after the analyses of modern technology trends and their possible impacts to the changes of the world market, and also the changes in required profile of new IT professionals and developers. The open-source hardware and single board computers are proposed as core elements of the new IT curricula labs. The efficiency of proposed components is proved by the long term research and variety of scenarios, used for teaching, making student projects and academic research.

The next step in this research can be made in different direction. Primary research direction will be in definition of efficient laboratory sets, built around mixed equipment and with different profiles of devices. In this case, laboratory will be able to support teaching variety of development platform giving students more generalized knowledge about the IoT and WSN and related technologies. Also, the student will be trained to work with different architectures and development tools.

This task is very hard but feasible, considering that all platforms are low-cost and having a large number of common features. The assumption is that with the careful planning, the future IT lab can be built around small number of specific laboratory sets that can be used in turn by students. Such platform diversity will allow much larger choice of different leaning and training scenarios.

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SCIENTIFIC

PAPERS

DEVELOPMENT AND INFLUENCE OF INFORMATION TECHNOLOGY ON TEACHING

Adapting University Teaching
to the Needs of IT Industry

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Abstract - One of very important aims of University study programs is related to professional empowerment of students. University study curricula are designed in aim to enable students to learn contents that are related to their future profession. Study contents as well as other study aspects (such as educational equipment, teacher training etc.) should be adequate to the needs of professional environments and should adapt to constant changes. These changes are more frequent in technology related university teaching, such as in information technologies area. This paper presents results of analysis of current state and processes in adapting university study process (including curricula changes and other activities) to the needs of IT industry.

I.   INTRODUCTION

IT industry and modern business express high speed of changes, including new jobs that need specific workforce skills and employment requirements. According to [1], the IBM Institute for Business Value surveyed a group of academic and industry leaders about current state of higher education in USA. Results of the survey show that 60% of survey respondents believe that higher education fails to meet the needs of industry. "Industry and academic leaders revealed that the very skills needed for workforce success are the same skills graduating students lack – such as analysis and problem solving, collaboration and teamwork, business-context communication and flexibility, agility and adaptability. 71% of recruiters indicated that finding applicants with sufficient practical experience is their greatest challenge when recruiting from higher education institutions. Boosting the value of today's higher education system means adapting to more practical and applied approach to education and providing experience-based and practical learning. Integral to this is building and expanding partnerships between academia and the private sector to create a more valuable education ecosystem."[1]

Universities have three roles in society – teaching, research but also it includes the role of leaders in regional economic and social development, being engaged in human capital formation [2] as well as innovative methods and technical solutions delivery. These roles are closely tied with society – industry, government and citizens. Since the adaptation of higher education to the needs of business companies and technology changes is immerse, the aim of this paper is to examine different approaches and practices in this adaptation.

II.   TRENDS IN HIGHER EDUCACTION

Policy in higher education transformation for the benefit of society is driven by needs of business companies that seek for skilled workforce. Technology change is second source of university teaching and research improvements. In aim to improve quality of higher education, many universities are encouraged to improve their educational technology, as well to improve their collaboration with business companies.

In [3], future trends in education are presented with results from analysis of most innovative educational institutions. These trends are specified as the constant need for adaptation, taking into consideration that [3]:

- Students will interact with others remotely,

- Education needs will drive technology use, but success will still rely on skilled teachers,

- Degree offerings will shift toward more relevant competency-based programs and more aggressive competition for students,

- Competency-based certifications testing specific skills and bundling individual skills into professional groupings will become global currency for both employers and job seekers,

- The need for engaging and respecting students and families as wellness partners in educational process as the service.

III.   THE ROLE OF UNIVERSITY IN REGIONAL DEVELOPMENT

The primary role of university is teaching and research. Third role is conceptualized in policy research papers (such as [2], [4], [6]) as the role in regional economic development. Figure 1. presents

core activities of higher education institution (teaching, research and service to the community) and values that these activities add to society of a region – skills, innovation and culture [4].
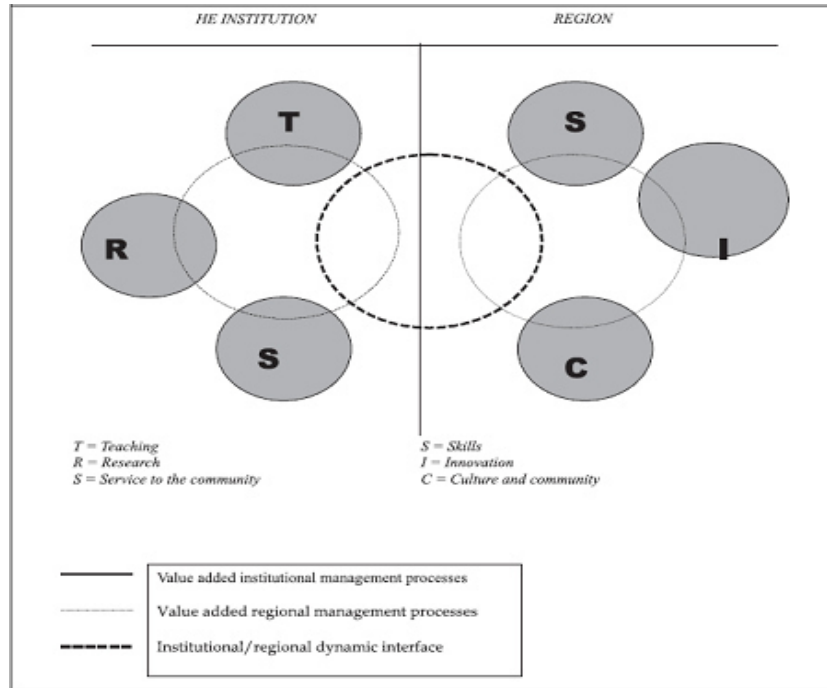
Figure 1.   The Institution/Region Value-Added Management Process [4] [9]

IV.   ORGANIZATIONAL FORMS IN UNIVERSITY RELATIONSHIP TO INDUSTRY AND GOVERNMENT

The triple helix model [5] presents relationship of university with industry and government, with overlapping areas. Figure 2. represents three models presented in historical order of appearance [5]: a) "Statist" model – government controls industry and academia, b) "Laisez-Faire" model – government, industry and academia apart from each other,

interacting modestly across strong boundaries, c)"Triple Helix" model – "University, Industry and Government enter into a reciprocal relationship with each other in which each attempts to enhance the performance of the others. The first step toward a Triple Helix is usually collaboration, taking place through their traditional roles, among the institutional spheres most involved with innovation".[5]
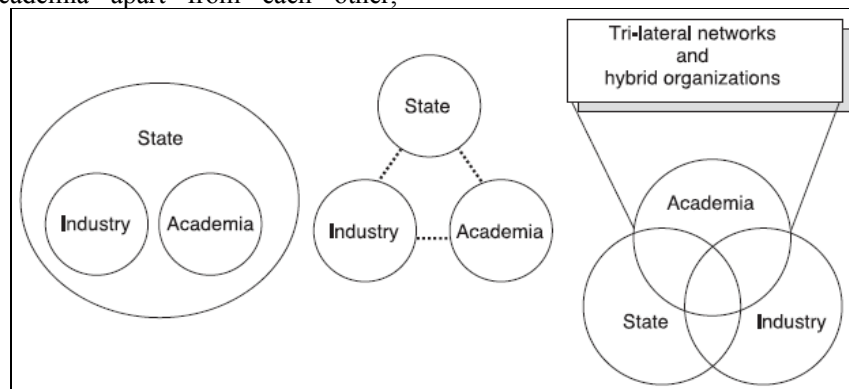
Figure 2.   "Statist" Model, "Laissez-Faire" model and "Triple Helix" model [5]

"The Triple Helix also becomes a platform for institution formation, the creation of new organizational formats to promote innovation, such as the incubator, science park and the venture capital firm" [5], or organization forms such as innovation and research centers [6] etc. This way, complex systems are established with collaboration of different institutions as innovation systems [7] [8].

It is of a great interest to enable universities respond to the regional development and workforce skills needs [9], but also enable universities integrate in international educational, research and technology activities, according to wider – worldwide established perspective for strategic directions in market and employment. Table I. represents key elements of regional innovation system and contribution of universities in generative and developmental role [7], [8].Figure 3. presents the role of university in industry development – creating, enabling and improving existing industries [13].Table II presents typology of university-industry links and Table III presents priorities for university-industry partnerships, along the three missions of universities [14]..

TABLE I. UNIVERSITIES' CONTRIBUTION TO THE DEVELOPMENT OF REGIONAL INNOVATION SYSTEMS [7] [8]

Key element of regional innovation system	Generative role	Developmental role
Regional agglomeration, or clustering, of industry	• Knowledge capitalisation and capital formation projects, centred on firm formation and co-location of new and existing firms near the university	• Entrepreneurial activities, as well as regionally focused teaching and research, not necessarily linked to capital formation projects
Human capital formation	• Integration of education and knowledge capitalisation activities, specifically, firm formation, through teaching incubators • Development of generic, advanced training programs to support firm formation and cross-institutional mobility by organisations and people	• Stronger regional focus on student recruitment and graduate retention • Education programs developed/adapted to meet regional skills needs • Learning processes regionally informed
Associative governance	• Driver of regional innovation strategy, centred on knowledge capitalisation and capital formation projects; by analysing strengths and weaknesses and bringing together industry and government to forge innovation strategy	• Shaping regional networking and institutional capacity, through staff participation on external bodies; provision of information and analysis to support decision-making and brokering networking between national and international contacts and key regional actors
Regional cultural norms	• Tradition of university/industry linkages, involving knowledge capitalisation	• Tradition of university/industry linkages, involving knowledge capitalisation and other research collaborations
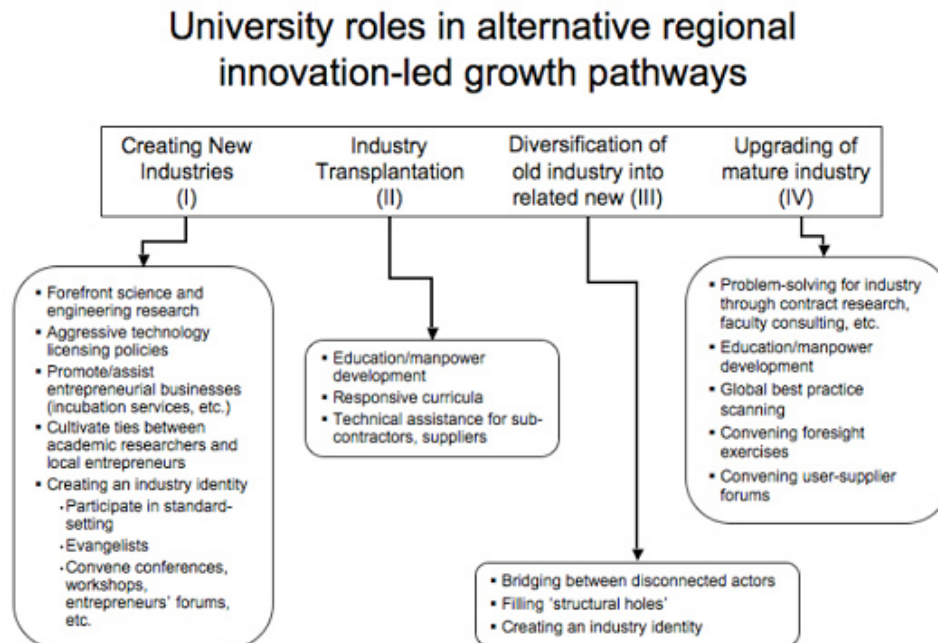
Figure 3. The role of university in development of industry [13]

TABLE II. TYPOLOGY OF UNIVERSITY-INDUSTRY LINKS, FROM HIGHER TO LOWER INTENSITY [14]

High (Relationships)	Research partnerships	Inter-organizational arrangements for pursuing collaborative R&D, including research consortia and joint projects.
	Research services	Research-related activities commissioned to universities by industrial clients, including contract research, consulting, quality control, testing, certification, and prototype development.
	Shared infrastructure	Use of university labs and equipment by firms, business incubators, and technology parks located within universities.
Medium (Mobility)	Academic entrepreneurship	Development and commercial exploitation of technologies pursued by academic inventors through a company they (partly) own (spin-off companies).
	Human resource training and transfer	Training of industry employees, internship programs, postgraduate training in industry, secondments to industry of university faculty and research staff, adjunct faculty of industry participants.
Low (Transfer)	Commercialization of intellectual property	Transfer of university-generated IP (such as patents) to firms (e.g., via licensing).
	Scientific publications	Use of codified scientific knowledge within industry.
	Informal interaction	Formation of social relationships (e.g., conferences, meetings, social networks).

TABLE III. PRIORITIES FOR UNIVERSITY-INDUSTRY PARTNERSHIPS AT DIFFERENT STAGES OF ECONOMIC DEVELOPMENT ALONG THE THREE MISSIONS OF UNIVERSITIES [14]

	Most developed countries	Least developed countries
Teaching University	• Private participation in graduate programs • Joint supervision of PhD students	• Curricula development to improve undergraduate and graduate studies • Student internships
Research University	• Research consortia and long term research partnerships to conduct frontier research	• Building absorptive capacity to adopt and diffuse already existing technologies • Focus on appropriate technologies to respond to local needs
Entrepreneurial University	• Spin-off companies, patent licensing • Entrepreneurship education	• Business incubation services • Entrepreneurship education

V. EDUCATIONAL TECHNOLOGY AND CURRICULUM CHANGES

The "Knowledge Society" requires workforce with skills appropriate to the needs of industry. Graduates from universities or those with acquired knowledge and skills from other knowledge-oriented institutions ("knowledge industries") continue education within lifelong learning. "Those involved in university teaching in this digital age must cope with the fact that the knowledge industries are creating the means by which individuals can acquire the immediate skills and knowledge those industries need. As a result, many individuals are questioning the true benefit of a university education, given its cost."[10]

"Universities wishing to respond to these new demands need to answer two difficult questions:

1. *How should the curriculum balance expert knowledge and practitioner knowledge?* Universities are comfortable teaching specialist knowledge produced by experts, but practitioner knowledge and the skill to develop it, which is what the knowledge industry needs, is not a natural part of university curricula. Should universities move into this area at the undergraduate level or should they leave it to the postgraduate, post-experience programs within the private sector?

2. *To what extent is a degree course a long-term grounding for an individual?* A degree certifies the knowledge that graduates have developed when they leave a university, but most graduates use very little of this knowledge in their subsequent careers. The more enduring qualities gained are the skills, attitudes, and ways of thinking derived from courses. But degrees and syllabuses are still defined in terms of subject knowledge, rather than generic skills. Should universities focus courses and teaching more on the practice of high-level skills, or should they leave this to individuals to develop through subsequent work in the knowledge industries?" [10]

According to [10], essence for answering these questions are in teacher/student communication

during teaching process, where both theoretical and practical elements are exchanged, as presented at Figure 3. The presented conceptual framework gives

the model that could be used for evaluation of ICT (Information and Communication Technology) use in teaching process.
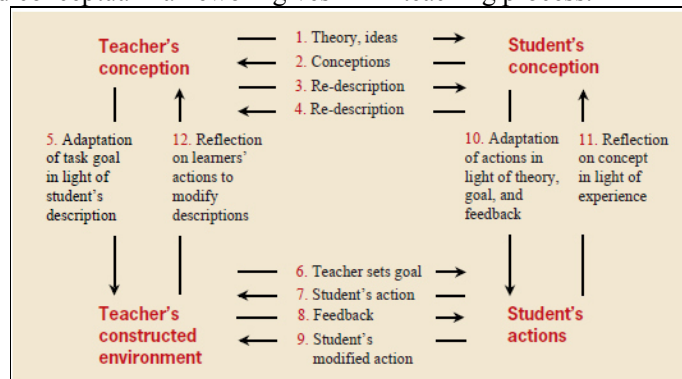
Figure 4. Conceptual framework of teaching process with theoretical and practical elements [10]

With an example of educational software particularly designed for this purpose, in [10] has been shown that ICT could be used for teaching process enhancement for the benefit of both knowledge and skills development even in high-level cognitive skills and practitioner-based skills. In [10] has been emphasized that university teaching should move focus towards more applicable skills to be developed with students, in aim to address the needs of industry.

Curriculum innovation issues, according to the needs of industry, are analyzed in [11]. This paper presents experiences from several universities from United States of America. Particular business-oriented skills are taught within regular subjects at master level of studies, enabling student to enter the professional environment efficiently. The concept of internship as mandatory final requirement at master-level studies requires 250 working hours within a company, which polishes knowledge and skills needed for particular company and enables student to enter that company as an employee.

VI. ICT HIGHER EDUCATION AND INDUSTRY COOPERATION INITIATIVES

IT-oriented area is particularly important, because of high speed of innovation. Information technology changes need to be included in teaching process as topics, as well as educational technology tools. In [11] special focus has been set to curriculum changes and organizational forms for improving IT-related higher education. Best practices examples are given from several U.S.A. universities.

One of organizational forms for improving cooperation between university, government and business is formal establishment of a consortium (in this example it was Mobile Technology-oriented

consortium) that gathers universities, business companies and government agencies for their mutual interest fulfillment. "This vision and mission statements of collaboration and innovation translated to the following goals: (1) to identify common needs/topics/projects for the consortium, (2) to collect needs of the local entrepreneurs and businesses, (3) to provide a quarterly session for status updates, (4) to review "hot technology topics" to enable emerging businesses and (5) to find best students match to local businesses." [11]

Another examples [11] included students in case-studies projects and continuous improvement projects guided from partners from industry, where students are engaged in teamwork together with industry representatives. Project results are discussed with students and industry representatives regarding project impact on learning outcomes and employability. Third example ("Motorola Mobility") influenced teamwork projects to be included in engineering curriculum, where students are exposed to real-world challenges. Successful examples show that students developed many marketable solutions - Android applications. These success stories lead to enabling other areas (such as robotics and semantic web) for teamwork projects. After graduation, some of the included students even started their own small business.

VII. THE ROLE OF ICT AND COLLABORATION OF UNIVERSITY WITH OTHER INSTITUTIONS

The role of ICT in future of higher education, as well as the role of ICT as study program (curriculum) combined with the general role and future of higher education institutions within the society is represented at research results presented at [12].
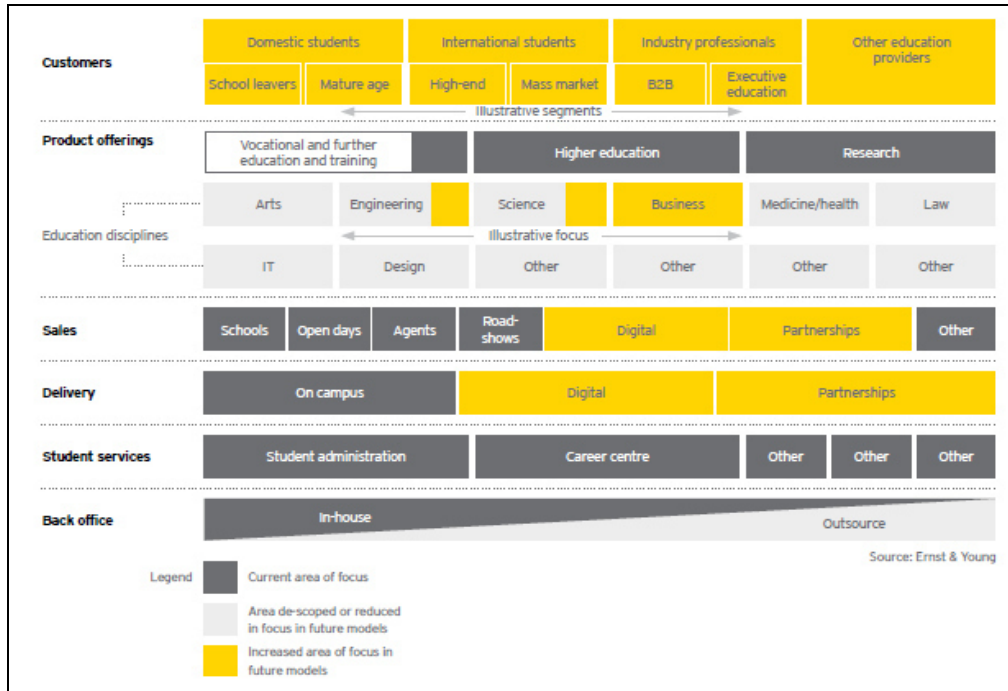
Figure 5.   Model of future universities, with market and ICT usage orientation [12]

It could be concluded that "sales" include increased focus on digital and partnership channels and also digital and partnerships channels of "service delivery". Strong society connections (mediated with use of ICT) are also presented as needed for the future university model where "customers", i.e. "service consumers" could be among professionals, international students, other education institutions employees etc.

VIII.   CONCLUSION

Modern business is faced with fast change influenced by technology improvements and increasing demand for quality workforce, depending on higher education institutions, as well as to other "knowledge industries".

The main roles of universities are teaching, research and development of society with their research, innovation and teaching activities. These activities should be strongly supported by new ICT technologies and partnerships with other institutions, in aim to modernize their educational and research processes.

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EDUCATION AND ICT-ITS CURRENT TREND AND OPPORTUNITIES IN NIGERIA

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Abstracts - Nigeria has experienced major boost in information and communication technology. This sector has been used by some countries to generate jobs, thereby reducing unemployment. It is generally acceptable fact that, India has used same sector to create millions of direct and indirect jobs every year. What are the present discoveries in Nigeria? Implementation methods used in Nigeria would be compare to what is obtainable in India.

I. INTRODUCTION

Typically, Nigeria has invested a lot in ICT for some years but what are the footprints it has left for industries, educational institute and business? Are there challenges militating against technological development of ICT? ICT as it has been seen and used by other developed countries in the world, have made a big leap by investing both in infrastructure and capacity building that will thrive ICT sector. In the real world, Nigeria should have invested its resources toward exporting IT services to other developing countries in the world but there are confrontations that need to be overcome. However, Nigeria is seen as the giant of Africa…Yes, indeed, she is Giant, but has she played her role in promoting all sectors of economy apart from crude oil? Basically, with the population of Nigeria, I think she should have made judicious use of this sector to create millions of jobs that are needed by Nigerian.

From the technological view point, Nigeria has resources to create either direct or indirect millions of jobs for her timid youth.

II. REVOLUTION IN INFORMATION TECHNOLOGY

The world has recorded significant growth in technology and to sustain the development, researchers have being using their findings to change wavelengths of technology in the world. USA, India, Japan and Australia to mention but few, have recorded tremendous achievements with the rightful application of ICT. Hardware and software industries have shown to the world that there are more to be discovered if players in the sector could work with their limited resources.

III. NIGERIA CASE STUDIES

Nigeria as the giant of Africa has all stands to make a positive impact and implementation in ICT industries, but nothing has been done on this sector because of prevalent challenges in power sector that have affected virtually all sector of the economy. With these challenges, Nigeria has to solve the problem of power before any laudable achievement could be achieved.

Apart from power problem, I think Nigeria ICT educational sector still lag behind in terms of curriculum. Higher percentage of Nigeria tertiary institutions still dive in what we call old curriculum. It is a sad thing, when you hear Nigerian graduates boasting of modules like Q-basic, fotran, Pascal etc. What exactly can they do with these aforementioned programs? Can they develop any meaningful application with these? Can they be employed by an ICT companies in Nigeria or outside the world? These are questions that roam within me when my institute interview graduates of computer science.

Technically, this same problem could be solved if there is adequate technology transfer from developed countries to assist Nigeria to develop his ICT sector up to what is obtainable in India, USA, Japan etc. Apart from seeking for help from expatriate, Nigeria tertiary institutions need to update their curriculum to what is obtainable in the world.

IV. INFRASTRUCTURE

Nigeria has problem relating to infrastructure and facilities to positively impact Information Technology. We have noted couples of problems that caused partial utilization of IT resources.
The cost of internet access in Nigeria is one of the highest in the entire sub-Sahara Africa.

Take for example, browsing internet at a local café in Ghana cost less than 50cedis (20cents)—this is a type of café where all basic facilities like headphone, speaker, air condition etc are rightly available

But in Nigeria, the cost of browsing at a local café is cost between 170 Naira to 200 Naira ($1) depending on the location.

The high cost in Nigeria is due to lack of basic infrastructure like:

- Electricity,

- High cost of running of base station/mast's generator with diesel.

- Cost of connection

- Instability in Government policies

Figure 1.   Picture Of Telecom Mast/Based station

Research has been conducted in Nigeria to link the relativity of IT to economic development. Based on our findings, we have discovered that

V.   SCHOOL CURRICULUM

A. Private Sector

An average Nigeria college student is more equipped with basic IT skill than those in tertiary institution. Most especially, students in Private schools have access to basic IT training because their parent or schools could afford it. Private schools in Nigeria have seen IT as one of the curriculum or training that should be given to primary pupils and secondary school students. From research conducted by Bluescripts IT, we discovered that, interesting number of private schools recruit IT instructors to train and equip their students with basic computer fundamentals, not only that, they stretch forward to equip their students with professional IT trainings like:

Introduction to Programming language

- Web Design

- Web Development

- Ethical hacking (CEH)

- Blogging

- Hardware (A+)

- Networking (N+)

- Etc.

With these exposure to IT technological trainings, students in private schools are better than their counterpart in public school. As a matter of fact, there are high schools in Osun State, Nigeria where students are taught advanced IT skills like Robotics, Mobile Apps Development etc.

B. Public School

There shouldn't be any technological gap between public and secondary school but this has happened over the years to low class students that attend public schools. Checking curriculum of public schools, we discovered that virtually all public school has no content for IT education. They are under privileged; they can't compete with their counterpart on IT. However, there should be measures to address the shortfall of IT instructors in Public schools. Can public schools pupil and students really have resources for IT training? In a typical school in rural areas in some Sub Sahara Africa, it is a big challenge for student to

Figure 2.   Typical Public School Classroom in Sub Sahara Africa

VI.   TERTIARY INSTITUTION CURRICULUM

Some of the private institutions in Nigeria have taken giant steps to introduce their students to industries standard courses that will make the students competitive at the international or local labour market.

Studies show that, less than half of private institutions in Nigeria train their students on professional IT skills. The so called training have

been left into the hands of IT training centers like Bluescripts, New Horizon, Aptech etc .

Whereas, public institutions are busy developing their students on courses that are not relevant in the labour market, Majority of the institutions still train their students on Q-basic, fotran, cobol etc.The question is this, what will a graduate with such training contribute when he get to the labour market.

The world of IT has changed and I believe government should take drastic method to create policies or create enabling environment where industries standard IT training would be given to Nigerian students

Nigeria graduates are half baked or not well informed on trending IT content, this has given opportunities for India nationals and other developed countries national to stand as majors

Can the ICT sector of Nigeria developed with the content of

Where there is need to create change, the sector is drawing the country backward with the content of its IT.

VII. CONTEMPORARY SOLUTION

To address these lingering problems, I will draw a chart that will define what Government has to do and what the private sectors must comply with before there could be any laudable achievement in Nigeria ICT sector.

Proactive measure should be taken to design programs that will infuse IT curriculum in all level of education in Nigeria. Basically, it has to start from Primary schools, where foundation for IT education must be formed. Also, teachers at this level must be trained by professionals that understand Nigeria language as this will foster understanding of the program by the pupils living in rural areas who don't understand English language. Policies must be formed and investors must also contribute their own quotas by providing resources and training gadgets. These are necessary resources that must be put in place for effective training of student:-

- IT laboratory

- Hardware i.e Laptops or Desktops

- Study materials

- Projectors

- Internet connectivity

VIII. INDIA EXAMPLE

India has remained one of the top IT countries in the world. In fact, India occupies the 2nd position, after USA. India is moving towards an innovative society because the most elite institutions in India engage with industries to promote innovation.

The Government of India implemented digital India few years ago, it has also used his resources to redevelop to sustain ICT in Nigeria.

IX. CONCLUSION

Nigeria, and the entire Sub-Sahara Africa countries, has great potentials to tap from the pool of opportunities that are hidden in ICT. To achieve this, policies that will drive ICT sector should be enacted. Power sector need to be revive, ICT training must be made a core course in primary and secondary schools. Moreover, Higher institutions in Nigeria and Sub Saharan Africa must re-equip and retrain ICT instructors, institutions curriculum to be update my bodies regulating tertiary institutions. All these must be addressed before there could be any meaningful development in this sector.

In conclusion, to reduce or end employment in Nigeria and Sub Saharan Africa, ICT education must be given the necessary support and policies.

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Design of User Interface for Educational Purposes in Eclipse Environment

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Abstract - In computing, graphical user interface or GUI is the type of interface that allows users to communicate with electronic devices through graphical icons and visual indicators. Integrated Development Environment (IDE) is a software application that provides comprehensive benefits for developers in software development. In this paper it will be described how one user interface can be designed using Eclipse environment. The environment itself, as well as given interface can also be used for educational purposes. Use of computers in education should enable innovation of teaching methods through diversity of learning and teaching practices.

I. INTRODUCTION

When we talk about the graphical interface, we should first define its meaning. The visible graphical interface of an application is called GUI (Graphical user interface) and represents a software environment that allows the user adequate communication with a computer using pre-defined functions.

The user interface must support the following activities:

- Perceptive - visual grouping of elements, use of color, sound and animation,

- Cognitive – time of solving tasks, short-term memory, the course of carrying out tasks,

- Learning - online materials, help with the work,

- Interaction - giving feedback,

- Accessibility – support of interaction with assistive technology,

- Usability - is a qualitative measure of the experience of using a program that is viewed through the learning ability, efficiency, ease of memorization, errors, user satisfaction [5],

- Work - in groups and collaboration.

With the use of computers and modern media in teaching, conditions have been created to quickly track down the source of knowledge, faster and better acquire knowledge, develop intense cognitive abilities, critical thinking and creative potential of students. In this environment students and teachers can communicate more freely and express their personality in the process of teaching and education.

II. GUI CHARACTERISTICS AND EDUCATIONAL PURPOSES

Stages of development of the user interface are as follows [1]:

- Requirements specification,

- Analysis,

- The development of the prototype,

- Design and implementation,

- Evaluation.

To be functional, GUI should be implemented as follows:

- Design - is the realization of the model: the working environment, menus, icons, navigation buttons, input devices, control actions on user requests and understanding the client's needs and objectives in terms of age, gender, expertise, knowledge level, limitations and special needs;

- Prototype - means implementation: practical parts of the user interface, various versions of the user interface, functional prototypes in paper form, in the form of animation;

- Evaluation – of the individual parts of the user interface, as well as of the whole product, testing by users, which will help in correcting potential errors as well as the testing of customer satisfaction prior to finalization of the design process.

When we speak of interactive educational purposes of software, user interface design of such product should include the following aspects [3]:

- Words, icons, graphics - terminology, abbreviations, capitalization, letter size and font style, navigation buttons, graphic elements, use of color, background;

- Appearance of the screen - the choice of style of interaction, formulating feedback and error messages, formats of data entry;

- Input and output devices - hardware platform: keyboard, monitor, control keys, mouse, sounds, assistive technology;

- Action sequences - software platform: clicking the mouse, drag, syntax and semantics of management actions, shortcuts and function keys;

- Training - help and instructions on the Internet, training material and literature, user's guide for the work and the like.

Due to the different characteristics of younger users concerning computer use, requirements are different when creating educational software for children. Starting from these assumptions, we can divide them into 3 groups: children who have not had any contact with computer technology, children who have a home computer but use it very little and children who have a home computer and use it often. However, sometimes we cannot rely on this division, because it can happen that children, who often use the computer for a particular activity, cannot overcome some other task very quickly because of the superficial approach to using computers. On the other hand, children who are less likely to use it can be committed to meaningfully use computers more. Therefore, software must be designed so that it corresponds to a wider audience, taking into account the above-mentioned groups of children, as well as variations in the classification.

The types of learning by children must also be considered [2]:

- Verbal type – learns by reading and writing, likes to receive instruction before tries to do something independently,

- Action type - learns without reading the directions, immediately begins the activity, likes to solve problems independently,

- Observational type - likes to learn by listening, enjoying lectures,

- Cooperative type - likes to learn in groups and share experiences.

III. DESIGN OF GUI IN ECLIPSE

It is believed that the proper use of modern communication technology can improve the accessibility of teaching staff and allow less active students to have better communication. At the same time, it increases the exchange of useful resources and joint problem solving that leads to better cooperation among students and a greater involvement in a common learning process.

Also, the best way of introduction and integration of technology into teaching should be found and not just present it as an optional unstructured activity. In this case, the students will not use it, thinking that it was redundant and having no strong reason to do otherwise. Integration should be subtle and simple, so as not to create more trouble than good in the process of acquiring knowledge. For the use of modern educational technologies, rational exploitation and adaptation to new forms of learning and teaching, it would be significant to improve forms of education of teachers, because they are the creators of flows and the outcome of the pedagogical process.

There is a need to apply ICT in teaching, to allow students to acquire knowledge and education in media enriched environment, which employ more receptors in obtaining information and that individualizes content and method of teaching. This makes the effects of teaching process considerably higher because the student is able to acquire knowledge and skills in accordance with his own needs, abilities, and preferences.

Eclipse is an integrated development environment that contains basic workspace and extensible plug-in system for adjusting the environment. It is written mostly in Java, but by using a variety of plug-ins, Eclipse can be used to develop applications in other programming languages such as Ada, ABAP, C, C ++, COBOL, Fortran, Haskell, JavaScript, Lasso, Lua, Natural, Perl, PHP, Python, R, Ruby, Scala, Clojure, Groovy, Scheme, and Erlang.

Many classes for GUI in Java are already predefined and have a large number of graphical representations. They are made in accordance with the JavaBeans specification and are often called the (graphical) components. Creating graphical interface is largely about combining these components in appropriate ways. These tools allow you to create GUI graphics and design by using the graphical palette. After achieving the desired appearance, these tools automatically create code, i.e. call the appropriate class.

First, it is necessary to make a new project in the Eclipse environment with the name PozdravGUI. The next step is to create a new graphic interface. Right-click on the project name or the "src" folder, and from the menu choose New> Other from the window that appears, choose WindowBuilder> Swing Designer> JFrame and choose Next. In the Name field, enter the name of the graphical interface - "PozdravGUI" and click "Finish". The new graphical interface, PozdravGUI.java class is

created, and by switching to Design view you can see its appearance. Since the interface is now set, some graphical components on the Form should be added. Before that, a pre-defined layout components need to be selected which will form a so-called Layout.

Now we can proceed to adding components. The first that is added is the label. In the palette on the left, click on the JLabel, then click on the form at the position where we want to put it. At this point a label is created and content can be added to it. As our text is too long to fit in the current dimensions of the label, we can change its dimensions. Content can be changed in the Properties tab by changing the value of the field "name". In the properties tab, we will rename the object to lblPoruka which we will later use in the code to call the method for editing a label.

The buttons are added from the palette by clicking the JButton components on the form. When the button is created, it is necessary to set up a text that is its actual heading. Setting the text can also be done by changing text attributes in the Properties section (Figure 1).

Each event can be associated with a component. To add an event handler for the button you need to go to a menu and choose: Add event handler> action> actionPerformed. Once this is done, the Java editor automatically creates a new method for the event handler - method Action Performed. Method Action Performed is going to be automatically invoked and executed every time someone clicks on the button. Action Performed needs to be set as:

Public void actionPerformed (ActionEvent e)

lblPoruka.setText ("POZDRAV");

To start the program from the package explorer it is necessary to right-click on the "PozdravGUI.java" from the menu and choose Run as> Java Application.
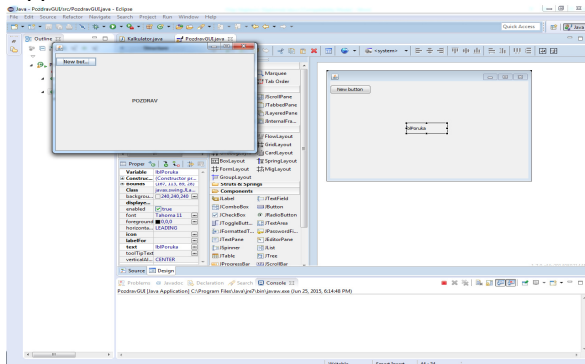
Figure 1. Setting labels and buttons

Now we need to add fields for reading and writing of text (Figure 2):

- It is necessary to create a new project in the Eclipse environment;

- The next step is to create a new graphic interface with the name kopiranjeTekstaGUI;

- Add buttons to form; one with the name btnKopiraj and another with the name btnIzlaz,

- Add two labels, one with the title Enter the text and the other with the title Text,

- Add an input field named textFieldUnos. To do this, you need to choose from a range of JTextField and add it to the form. When added, it is necessary to adjust its position and size. Entry field JTextField component serves the user to enter some text or number via the graphical interface;

- Same method is used to add another field to print (write) the text out called textFieldIspis;

- Add event handler with the following code:

public void actionPerformed (ActionEvent e)

String text = textFieldUnos.getText ();

TextFieldIspis.setText (Text);

lblIspis.setText (Text);

- Add an event handler for the button btnIzlaz. It is necessary that, when the user clicks this button, it terminates the program:

public void actionperformed(ActionEvent e) {

System.exit(0);

}
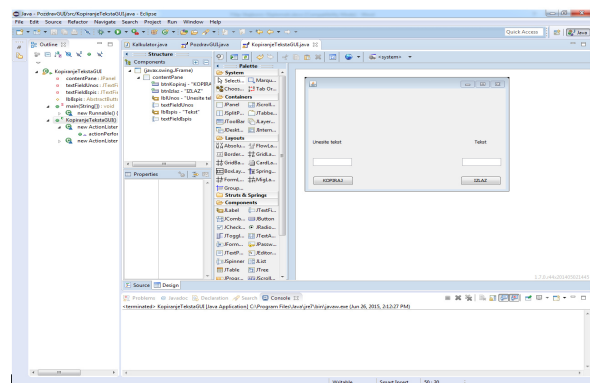
Figure 2. Field for entering and printing of content

Creating a text editor goes as follows (Figure 4):

- It is necessary to adjust the shape to be a Border Layout. This type of layout is divides

a form on five independent parts in which he components are stored: the north (North), South (South), West (West), eastern (East) and central. The principle of functioning is as follows: if a component is placed in the northern part, it will always remain the same size and "glued" to the right edge of the form regardless of how much it changes the dimensions of the form. The same is true for the southern, western and eastern part. However, if the component is placed in the central part of the form, it will change its size depending on the size changes of the form itself.

- Click on containers within the palette and choose JScrollPane component. Add this component in the central part of the border layout.

- From palette choose JTextArea. This is a component that allows you to enter text in a single line. Add this component to the form.

- Click on containers within the palette and select JPanel component. This component is a one common surface (panel) to which the components can be stored. Adding can be done directly within the Components tab, by clicking on the contentPane.

- On the panel add the button with the name and label btnUcitaj "Ucitaj".

- Following the same principle add two more buttons: btnObrisi (label "Obrisi") and btnSacuvaj (label "Sacuvaj"). Form should look like in Figure 4.

- Add an event handler for buttons.
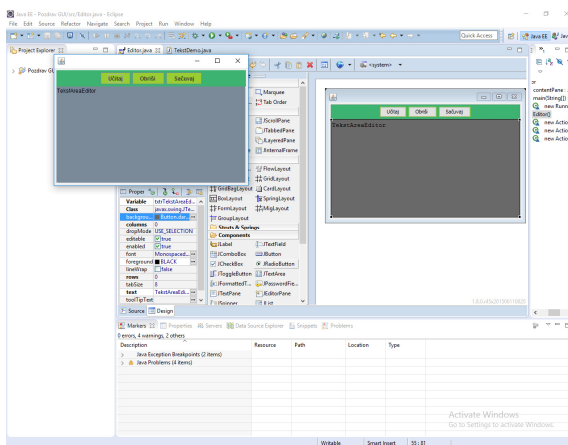
Figure 3. Creating a text editor

The use of computers in educational activities has become practically commonplace. In schools

they can be used for keeping records of library and teaching, student tracking, scheduling classes and others. The most important role is to modernize and rationalize the central educational activity, and that is teaching. Hence, if the basis for the analysis are the key points of didactics, we can conclude that the use of computers and the program (that was created as part of this work) in the classroom supports all the traditional didactic principles.

Therefore, the result of the work can be used in all stages of teaching and in different types of classes: for teachers to prepare notes, for students for repetition and practice, and even in the evaluation of certain skills. Technical computer capabilities that allow the prompt restoration and retention in certain parts of the program is important for the effective repetition. Electronic workbooks are ideal for exercising, and in this case, the program can be used to make notes of students during classes, or for typing and writing homework on the computer. Although working on computers is dominately individual work, joint work of students can be also successfully used. This program is based on open source code that can be easily distributed, can be used for the purposes of personal education, or to work on solving homework. Today, educational software is designed for all educational areas, so they not only contribute to the intellectual, but also to moral and aesthetic development of the students.

IV. CONCLUSION

The rapid development of technology has caused the emergence of a wider range of users who actively use software applications such as integrated development environment, Eclipse and NetBeams. Most IDE applications has the ability to complete the already initiated code, which significantly facilitates the efficient coding of amateur developers, and saves time of making the code for experienced users.

As for the design of the user interface is concerned, it is created based on subjective preferences, so it is useful to know the basic principles of design. However, it should not limit the designers to strictly follow them, because creativity, combined with the knowledge, mainly gives the best results.

The use of computers in education should enable innovation of teaching methods and management through restructuring and diversification of learning and practice. The constant technological progress requires the engagement of all stakeholders of education in order to successfully adapt to changes in society and the environment. This joint work

should result in increased efficiency and productivity of the learning process, as well as the overall improvement of education.

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MDX Queries for OLAP Cube Slicing and Statistical Reporting: Educational Example

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Abstract - This paper presents educational example for learning Business Intelligence at University of Novi Sad, Technical Faculty "Mihajlo Pupin" Zrenjanin. This example shows multidimensional expressions (MDX) for querying analytical data in Microsoft SQL Server OLAP Services. MDX queries are processed with OLAP cube created with regional basketball league data. Data for analyses were collected from web site of ABA league and transformed into a relational database, in a form suitable for processing in SQL Server Analyses Services. Several OLAP cubes were created in order to generate reports with parametrized queries. Statistics has been processed in spreadsheet and graphically visualized, based on OLAP cube as the data source.

I. INTRODUCTION

Students at Technical faculty "Mihajlo Pupin" in Zrenjanin have various courses, at Bachelor and Master studies level, for learning how to work with data warehouse, such as courses named: "Business Intelligence" and "Complex Databases". Educational content of these courses include: data warehouse as a concept of a complex database, decision systems support, comparison of operational data, time intervals, multi-dimensionality of the data, design of star and snowflake schemes, identification of users' requests, cube logical design, operational data extraction, queries standard extensions, data cube, as well as techniques to query and display the results in complex databases and design of data mining system.

Data warehouse is a well-known concept for creating various reports and extracting analytical data from database with Multidimensional queries (MDX) mechanism. This paper illustrates how MDX queries can be used as a support system for making decisions. Second section explains datawarehouse concept. Third section presents basic approach to OLAP cube design as well gives example of creating OLAP cube elements with example of basketball semantics. Fourth section presents examples of MDX queries made with data from basketball. Finally, fifth section presents statistics and graphical representation of statistical data that could be used for decision support.

II. DATAWAREHOUSE CONCEPT

Decision makers make their decisions on the basis of analysis of facts obtained from various processes and data sources. These facts are stored mostly in OLTP (on-line transaction processing) systems as well as some other data sources. Purpose of data warehouse system is to integrate the data obtained from existing OLTP and other data sources, conduct computation that enable performing analysis for decision making support [1].

Data warehouse systems are based on-online analytical processing (OLAP), which is intended for interactive analysis and reporting. It has become an important tool for executives, managers, and analysts to analyze, explore, and extract interesting patterns from enormous amount of data stored in OLTP systems [2]. OLAP systems are based on multidimensionality of denormalized data [3]. OLAP architecture requires data to be transferred to multidimensional structure called a cube, by extracting and transfering data, creating aggregated data, dimensions and measures [4]. Processing OLAP data cubes is a time-consuming process depending on OLAP server and data warehouse tools performances [1].

III. OLAP CUBE DESIGN

Data used for our analyses were collected from Internet site of ABA basketball regional league and transformed into a relational database [5]. In our case, we will conduct an analysis of the success achieved by players and teams in the ABA league in season 2013-2014. The second transformation of this data from existing OLTP database management system (DBMS) was into a form suitable for processing which enables performing analysis with data warehouse tool.

This database with basketball data was made up of following data tables from relational database: city, player, team, league, season, team statistics and individual player statistics per season and association

that connects teams and league. The player plays for the proper club (team) placed in a city and achieved results during the season are the data that was entered in the statistics table for each individual. This data are: total number of points, assists, offensive rebounds, defensive rebounds, blocks, errors, number of made and attempts for one, two and three points, and minutes made in the game.

OLAP cubes have been created as a new project in Microsoft Business Intelligence Development Studio (BIDS) which is based on transactional and relational Microsoft SQL Server DBMS. This project has a data source that connects BIDS with relational database with basketball data. After creating a data source view, user must define which part of database will be analyzed and has to define data source view. The next step in designing the OLAP cube was to define measures and dimensions. Physical architecture of dimensional model in OLAP can be described by a scheme that is defined by the stars or snowflakes from two types of tables - dimensional tables and fact tables that contain measures. Fact tables contain quantitative data that users want to analyze. These data are usually numeric type and can consist of up to several million rows and columns. Dimensional tables are much smaller and contain information describing data on which the analysis is performed.

Standard dimensions of the cube projected with star schema are:

- Team – Team_name,
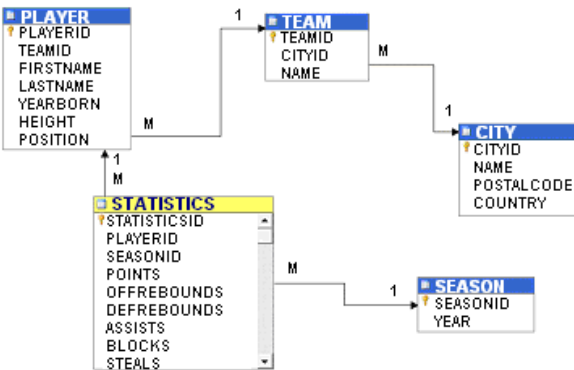
Figure 1. OLAP cube snowflake schema

- Season - Season_year,

- Player – First_name,

- Player – Last_name.

Measures for this cube are all defined for team: One point attempts, One point made, Two points attempts, Two points made, Three points attempts, Three points made, Total number of scored points, Total number of accepted points, Played games,

Offensive rebounds, Defensive rebounds, Number of errors, Number of steals.

Standard dimensions of the cube projected with snowflake schema ("Fig. 1") are: Team – Team_name, Player – First_name, Player – Last_name, Player – Team_name, Player – Height, Player – Nationality, Player – Birth_year, City – Name, City – Country, Season – Season_year.

Measures for this cube are defined for single player during the whole season: Two points attempt, Two points made, Three point attempts, Three points made, Number of assists, Played games, Minutes played per game, Total number of points.

For the cube based on snowflake schema shown on "Fig. 1" we had three computable fields: player percentage for one point (1%), player percentage for two points (2%), player percentage for three points (3%) and they are obtained by dividing the number of hits with the number of attempts for one, two and three points. For the cube based on star schema we had two computable fields: player average minutes per game, average points per game and they are obtained by dividing the points scored by the number of games played and total minutes played with the number of matches.

There are two ways for creating cubes. The first method is to create an empty cube, and then subsequently add the dimensions and measures. Another way is through the wizard within the steps to choose the dimensions and measures. We used a first solution to create an empty cube. The next step is to choose the appropriate data source view. In cube editor were added previously created dimensions, measures with aggregate functions (sum, count, count of rows, minimum, maximum, etc.) are defined as it is described in paper earlier, and finally the calculated fields were defined in the last step. When user choose to create a cube by wizard, through the set of windows there are following actions: choosing tables that will allow us to represent the facts and then program provides some measures that can be used or not. After that the list of dimensions is displayed with options for user to choose all of them or some, depending on the analysis type.

When the cube structure is finally projected user has to deploy the cube because the whole project is placed in various files in the project folder and the data is placed in one or more database management software files. Deploying may take a while, depending on the complexity of cube structure and the amount of data from database that have to be de-normalized and placed into the cube. After deployment there a browser can be opened where users have to place dimensions, measures and

calculated fields in a form that looks like pivot table. There are three regions for placing dimensions: on rows, on columns or on page as a filter for all aggregated data that have to be displayed. Measures and calculated fields must be dragged and dropped in central part of table.

IV. MDX QUERIES

Multidimensional Expressions as a language was introduced in 1998. It was created to query OLAP databases, and has become widely adopted within the realm of analytical applications. MDX forms the
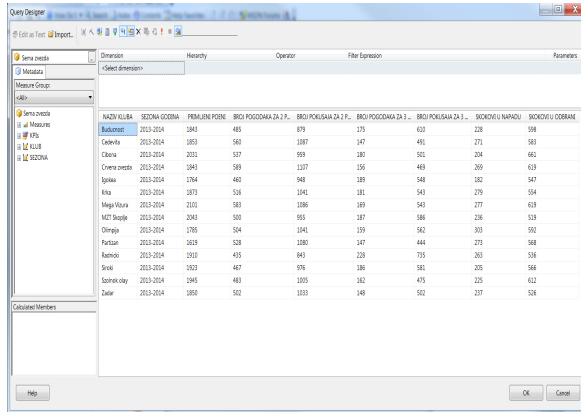
Figure 2. MDX query editor in BIDS software

language component of OLE DB for OLAP, and was designed by Microsoft as a standard for issuing queries to, and exchanging data with, multidimensional data sources. [6]

In BIDS studio MDX queries can be formed in query editor that is shown on "Fig. 2", placed in Reporting Services, a tool for OLAP reports project generation.

SQL Server OLAP services provide architecture for accessing to OLAP data through MDX. OLAP Services supports MDX functions as a full language implementation for creating and querying cube data. The MDX expressions simplest form of query presented in [7] is:

SELECT [axis specification] ON COLUMNS,

[axis specification] ON ROWS

FROM [cube_name]

WHERE [slicer_specification]

The cube that is targeted by the MDX query appears with its name in the FROM clause of the query [8]. The query syntax also uses keywords that are common in Structured Query Language (SQL), such as SELECT and WHERE. The axis specification contains measures or dimensions specification from the OLAP cube. The slicer specification on the where clause is optional. If not

specified, the returned measure will be the default for the cube. Difference between these two languages is that the output of an MDX query, which uses a cube as a data source is another cube, while the output of an SQL query is columnar table.

Example no. 1 of a simply MDX query:

SELECT {measures.members} ON COLUMNS,

[team_name].members ON ROWS

FROM [basketballstar]

Curled brackets "{}" are used in MDX to represent a set of members of a dimension or group of dimensions.

Example no. 2 of an MDX query:

SELECT

{[Measures]. [Three_points_attempts],

[Measures]. [Three points made],

[Measures].[Two_points_attempts],

[Measures].[Two_points_made],

[Measures].[Total_number_of_scored_points]}

ON COLUMNS,

{([Team].[Team_name].[Team_name]. ALLMEMBERS)}

ON ROWS

FROM [basketballstar]

Table I shows the result of executing query no. 2

TABLE I. TEAM STATISTIC

Team	2 Pts Md	2 Pts Att	3 Pts Md	3 Pts Att	Total Pts
Buducnost	485	879	175	610	1921
Cedevita	560	1087	147	491	1917
Cibona	537	959	180	501	2001
Crvena Zvezda	589	1107	156	469	2017
Igokea	460	948	189	548	1857
Krka	516	1041	181	543	1815
Mega Vizura	583	1086	169	543	2111
MZT Skoplje	500	955	187	586	1964
Olimpija	504	1041	159	562	1788
Partizan	528	1080	147	444	1817
Radnicki	435	843	228	735	1977
Siroki	467	976	186	581	1789
Szolnok Olay	483	1005	162	475	1793
Zadar	502	1033	148	502	1776

TABLE II.   PLAYERS INDIVIDUAL STATISTIC (PART)

First Name	Last Name	Team	2 Pts Md	2 Pts Att	3 Pts Md	3 Pts Att
Nolan Derec	Smith	Cedevita	131	283	21	66
Dario	Saric	Cibona	134	243	30	87
Jaka	Blazic	Crvena Zvezda	77	142	25	84
Nemanja	Gordic	Igokea	98	202	33	88
Edo	Muric	Krka	68	147	39	108
Ratko	Varda	Mega Vizura	94	188	19	58
Bogdan	Bogdanovic	Partizan	76	168	55	162
Tarence	Kinsey	Partizan	85	183	21	57
Mrko	Matinovic	Radnicki	53	110	50	184
Savo	Lesic	Radnicki	123	208	20	60

over OLAP cube projected with star schema.

Example no. 3 of an MDX query based on cube projected with snowflake schema:

SELECT NON EMPTY

{[Measures].[Three points made],

[Measures].[Three_points_attempts],

[Measures].[Two_points_made],

[Measures].[Two_points_attempts]}

ON COLUMNS,

NON EMPTY {

([Player].[First_name]. [First_name].

ALLMEMBERS *

[Player].[Last_name]. [Last_name].

ALLMEMBERS *

[Player].[Team_name].
[Team_name].ALLMEMBERS)}

DIMENSION PROPERTIES
MEMBER_CAPTION,
MEMBER_UNIQUE_NAME ON ROWS

ON ROWS

FROM [basketballsnowflake]

CELL PROPERTIES VALUE,
BACK_COLOR, FORE_COLOR,
FORMATTED_VALUE, FORMAT_STRING,
FONT_NAME, FONT_SIZE, FONT_FLAGS

Quite often an MDX expression will retrieve axis members when there are no values to be placed into them. Because of that in sample no. 3 is shown easiest form of filtering - removing empty members from the axis. It can be done through the use of the NON EMPTY clause as a part of the axis definition after SELECT statement.

Table II shows the result of executing query no. 3 over OLAP cube projected with snowflake schema.

After the FROM clause of a query can be specified following properties for output result report in Reporting Services project: cell properties value, back_color, fore_color, formatted_value, format_string, font_name, font_size, font_flags.

Example no. 4 of an MDX query that will retrieve 30 percent of Partizan team players with greatest total number of points:

SELECT NON EMPTY

TOPPERCENT
{[Measures].[Total_number_of_points]} , 30,
[Measures].[Total_number_of_points]

ON COLUMNS,

NON EMPTY {

([Player].[First_name]. [First_name].

ALLMEMBERS *

[Player].[Last_name]. [Last_name].

ALLMEMBERS *

[Player].[Team_name].
[Team_name].[Partizan])}

ON ROWS

FROM [basketballsnowflake]

The slicer specification, according to [6], in the WHERE clause is a dimensional slice of the cube. Thus the WHERE clause can, and often does, extend to other dimensions. It is important to note that slicing is not the same as filtering. Slicing does not affect selection of the axis members, but rather the values that go into them. This is different from filtering, because filtering reduces the number of axis members.

MDX supports many numeric functions and it allows more specific filtering and offers the FILTER function. During cube queries, all the members in a dimension have a natural order. MDX provides functionality for list sorted by the ORDER function and using many specific functions. Users can create and register own functions that operate on multidimensional data. [7]

Although the basics of MDX are enough to provide simple queries against the multidimensional data, there are many features of the MDX implementation that make MDX a rich and powerful query tool.
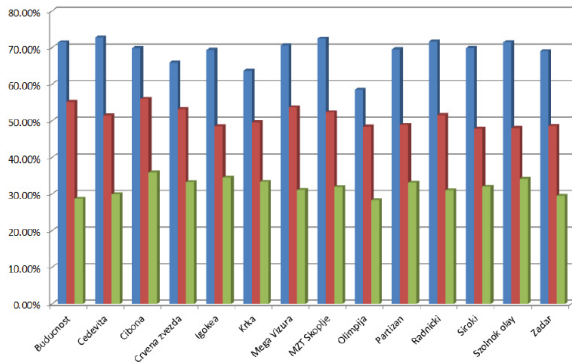
Figure 3.   Team statistics in percentage of shots [8]
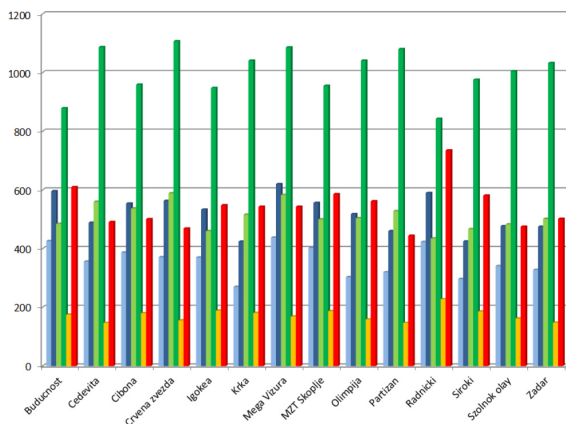
Figure 4.   Team statistics in total team shots [8]
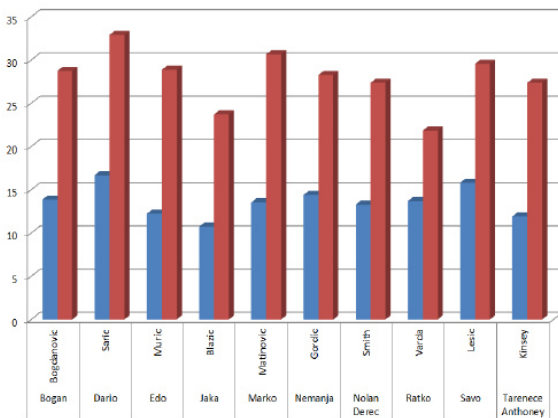
Figure 5.   Player statistics for average points and minutes played

V.   STATISTICS

The reports were created in the BIDS studio for table type reports and Microsoft Excel spreadsheet for graphs and charts. Excel is a very suitable tool for processing tabular data orderly. It is very useful in modern business where quality information is required. The advantage of Excel is that it provides

an interactive and direct work with relational database or OLAP data, so it can be used by people with different levels and types of education for automation primarily the personal business, without any programming knowledge.

In BIDS tool a new project was created from the list of templates as a report server type of project. The wizard guides user to create a report with a new and separate data source to OLAP cube. After that in a special tool called Query Designer, user has to create a MDX query for slicing data in cube that will appear in the report. MDX query for reading data that is necessary to design a layout table with similar syntax to SQL, but the difference is in working with cube dimensions and measures in MDX while SQL handles tables and columns of relational database.

For creating charts in Excel that are connected to data from OLAP cube, the pivot table must be put on worksheet. Pivot table is a dynamic table with pooled data from an external data source. This kind of table was a source for creating a special type of chart (Pivot Chart), with possibility for dynamic changes of graph series when the data in pivot is filtered for example.

"Fig. 3" is one of the created graphs with team percentages in shots for one, two and three points. First column filled with blue color presents percentage for one point, second marked as red is percentage for two points, and the green is percentage for two points.

"Fig. 4" shows in six series total shots for one, two, and three points. First series (column filled with light blue color) on the left shows total one point made. Second column filled with dark blue color shows one point attempts. Third column filled with light green shows two points made; while fourth column is for two points attempts. Fifth column filled with yellow color shows three points made; while sixth column is for three points attempts during the whole season.

"Fig. 5" shows in two series in first series (column filled with light blue color) average number of points for player while second column filled with red color shows minutes per game for the best scorers in the ABA league.

VI.   CONLUSION

The MDX query language is rapidly gaining the support of many OLAP providers, and this trend is expected to continue. Aim of this paper is to show educational example of how OLAP cubes and data warehouse with MDX queries mechanism could support statistical computation of data for basketball team management. Results of design and creating of

data warehouse are cubes with browsed analytical data, reports designed in reporting services and charts created in spreadsheet program. From this statistics, team management could plan and prepare the training process or tactics for matches.

Also, there are many interested potential users of this kind of data processing like various teams, academia, governments and authorities, sport governing bodies. Therefore, it is very important the use the data analysis, data processing model and data analysis technology which provide scientific basis and help coaches and teams leaders to make the specific decisions to win the final competition.

Further work could be in creating data mining structures in BIDS for more complex analysis for finding significance in the relationships between a specific data elements and creating data patterns.

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3D Printing in Education

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Abstract - Since the 1980s, 3d printing or additive manufacturing technologies have been used primarily as a tool to aid the product design process. Today it is more and more used in various areas, from industry, medicine, construction, and its benefits are also seen in educational sector. 3D printers along with 3D scanners can change how students see innovation and manufacturing, and help train engineers, architects, scientist and many other professionals. This paper will present some aspects and benefits of this technology usage in education.

I. INTRODUCTION

As the multibillion dollar additive manufacturing (AM) industry continues to evolve, a growing number of companies have adopted 3D printing to produce finished goods. The 3D printing market has been experiencing double-digit growth in recent years. When compared with traditional manufacturing, however, AM production volumes are diminutive, and the technology remains far from gaining mass adoption, especially in direct – part production [2].

The 3D printing technology made its way to the technological world in 1986, but was not fully noticed until 1990. It was not that popular outside the world of engineering, architecture and manufacturing.

Speaking of historically important moments, in March 1983, Chuck Hull, now cofounder, executive vice president, and chief technology officer of "3D Systems" company, created a small teacup by shooting a laser into a vat of UV - curable photopolymer. Dr. Hull built the first successfully produced 3D - printed object. In 1986 Charles Hull founded a company named "3D Systems" and developed the first commercial 3D Printing machine, called Stereolithography Apparatus. He named the technique as Stereolithography and obtained a patent. Today, according to Hull, "3D Systems has revolutionized the way companies design, present, prototype, and manufacture new products, empowering leagues of artists, hobbyists, and consumers to create previously impossible designs."

II. 3D PRINTING

When it comes to 3D printing, there are limitless ways in which the technology can be utilized. Businesses, hobbyists, and educational institutions are beginning to fully understand some of the potential benefits that the technology can provide. 3D printing has, and will continue to, provide a means for inventors, innovators, and visionaries to easily fabricate prototypes for designs which they could only depict via 2-dimensional drawings and diagrams in the past.

3D printing or additive manufacturing is any of various processes for making a three-dimensional object of almost any shape from a 3D model or other electronic data source primarily through additive processes in which successive layers of material are laid down under computer control. It can also be said that a 3D printer is a type of industrial robot. 3D printing is also known as desktop fabrication, because it can form any material that can be obtained as a powder. For creating an object, a digital 3D-model is needed that can be obtained by scanning a set of 3D images, or drawing using computer-assisted design or CAD software. Today thousands of models are available for download for free. The digital 3D-model is usually saved in STL format and then sent to the printer. The process of "printing" a three-dimensional object layer-by-layer with equipment is similar with ink-jet printers [6].

On a 3D printer the object is printed by three dimensions. A 3D model is built up layer by layer. Therefore the whole process is called rapid prototyping, or 3D printing.

A common process of rapid prototyping is to apply a fine powder (plaster, bioplastic, polyurethane, polyester, epoxy, metal, etc.) in such 3D inkjet printers. Printer prints out the layer of powder on a bed and forms a fixed object. The design is defined by a CAD file. Fused deposition modeling (FDM) is another method in which molten polymer is sprayed on a support layer and the model is built layer by layer. Another way is to use liquids, such as photopolymer, by the same inkjet-type head which is also printed each layer by layer. Following,

an ultraviolet light is used to activate the print head so that the liquid layer becomes a solid layer. This process is also well-known as stereolithography.

A number of trends are contributing to the adoption of 3D printing capabilities. First, compressed product life cycles and competitive pressure are forcing users to reduce new product time - to - market and innovation timelines. 3D printing can create geometries that sometimes are not possible with traditional manufacturing methods and can do so without increased costs. Thirdly, the push for companies across the board to reduce waste and energy consumption makes 3D printing an attractive option. In fact, many 3D printers allow users to recycle material after each use, cutting both waste and cost. Finally, a recent Engineering.com survey reveals that 66 % of engineers do not use professional 3D printers and 3D printing technologies, revealing a huge untapped market.

In the last couple of years the term 3D printing has become more known and the technology has reached a broader public. Still most people haven't even heard of the term, while the technology has been in use for decades. Especially manufacturers have long used these printers in their design process to create prototypes for traditional manufacturing and research purposes. Using 3D printers for these purposes is called rapid prototyping [5].

Besides rapid prototyping, 3D printing is also used for rapid manufacturing. Rapid manufacturing is a new method of manufacturing where companies are using 3D printers for short run custom manufacturing. In this way of manufacturing the printed objects are not prototypes but the actual end user product. Here you can expect more availability of personally customized products.

By reweaving the literature, three major challenges that the 3-D printing industry needs to overcome in order for adoption rates to improve have been detected:

- Organizational readiness: There's a high barrier of entry for a manufacturing company to get its operations and team in order. A lot of technical expertise around 3-D printing needs to be gained before a manufacturing operation can implement 3-D printing into its process.

- Technology: The majority of the design of 3-D printed objects is done by hand today. As you can imagine, this is not a very efficient approach for a manufacturer with millions of parts in its inventory. Until a streamlined and robust solution to automate this process

becomes readily available, this major bottleneck will continue to play out.

- Awareness - Labor force experience: Mainstream awareness of 3-D printing is very new, and consequently, there's very little formal education around the subject. The total expertise pool needed to get an entire economy on board with 3-D printing simply isn't available today.

III. 3D PRINTING IN EDUCATION

3D printing is versatile technology and has found application in almost every corner of human life (rapid prototyping, architectural scale models, medicine prosthetics and printing using human tissue, entertainment, reconstructing fossils in paleontology, replicating ancient artefacts, reconstructing bones and body parts in forensic pathology and reconstructing heavily damaged evidence acquired from crime scene investigations, etc).

Where 3D printing has yet to really make a huge impact, but provides an ample amount of opportunity, is within educational institutions. These range from elementary schools to high schools, and universities around the globe. One reason that 3D printing has been quite slow in making its impact in these institutions is simply because of the lack of knowledge of the technology by the decision makers in charge.

Because the technology is so relatively new, the greatest impact may come via the introduction of 3D printing into public and private grade schools. The younger a person is, the easier it usually is to introduce new ideas and methodologies. This is why young children are so quick to learn new languages, when compared to their older adult counterparts. This is what makes elementary schools, junior high schools, and high schools the perfect place to begin really introducing a curriculum based around 3D printing.

Following the impact of 3d printing, a movement has developed on university campuses that enables students across disciplines to learn by making and creating rather than from the simple consumption of content. Hands-on learning has become an integral part of the curriculum, giving students access to 3D printers and turning them into thinkers, designers and builders — the kinds of disciplines that form the heart of higher education in the 21st century.

Engineers gain design freedom because they can access every part of a printed piece during the build process, not just the exterior faces. They can create functional parts without the need for assembly.

Likewise, 3D printing allows the building of geometrics that couldn't be fabricated in any other way. Along the way, those capabilities reduce waste, minimize the use of harmful chemicals traditionally used for etching and cleaning, and offer the possibility for using recyclable materials.

A broad shift is taking place in American education to encourage more authentic learning: the kind of learning that helps students prepare for life after school. Authentic learning has multiple labels: project-based, problem based, inquiry learning. But at its heart, a student is given a genuine problem to solve that requires mimicking the work of professionals. Working toward an answer calls for the student to show creativity, collaboration and communication and to gain a deep understanding of both the problem and its possible solutions. The results, say those who have experience in this type of educational model, far surpass the impact of a typical classroom test. Done well, the learning takes on a self-directed aspect that helps to build student autonomy. While the practices supporting authentic learning can be started among very young children, it's more impactful for students in middle school and beyond. At that stage in their learning development, they often need a bigger charge to get excited about the concepts of design and engineering. They need to see their ideas come to form, and that's exactly what a 3D printer can deliver [2].

Just about every subject within a school curriculum could benefit from 3D printing technology. Some of them are:

- Mathematics - Most commonly 3d printing has been used to help students envision graphs and mathematical models. Some students have a difficult time grasping numbers and diagrams that they can only see on paper. This isn't a learning disability, but rather just the way that some of our brains function. 3D printing helps those students who have a more difficult time envisioning equations, elaborate graphs, and complex mathematical models to more easily see them through tangible representations. Most importantly though, 3D printing brings a "cool" factor into a subject which could normally be boring for majority of students;

- Geography - 3D printing is an excellent way for students to better understand geological formations on a scale that is not presentable through 2-dimensional images. 3D printing has helped researchers land a shuttle on a comet, by aiding in picking the best possible landing spot. We live in a 3-dimensional world, so having a chance to envision the geography and geology that we are being taught using a 3-dimensional tool would obviously be the preferred option.

If writers of textbooks can understand the importance of 3D printing and want to integrate it into the lessons, then they could include files for 3D printable models with each chapter in their books. This would provide for a fun, educational experience for students and teachers alike. Imagine printing out scaled down models of certain mountain ranges, rivers, canyons, etc. It would be a way to give kids a hands-on look at famous locations around the world without having to actually be there.

- History - is probably the subject that has the most to gain through 3D printing technology. Museums all over the globe are finally beginning to see the potential that 3D scanning and printing can have on not only making replicas of ancient artifacts, but also backing them up and providing a more hands-on feel of them. With the availability of high-end 3D printers and scanners, replicas can be touched, and many of these replicas are virtually indistinguishable from their real counterparts. Now imagine if every history class had the ability to 3D print replicas of artifacts from a massive library of downloadable STL files. Every classroom would now have access to museum artifacts from the luxury of their own school.

- Art - The technology will open a whole new realm of possibilities for art teachers. Lesson plans could expand to include 3D design, and become much more interesting, with students being able to bring their designs to life via 3D printing. Comprehensive projects could be taken on, on a national or even global level, with the ability to share 3D printable art design with anyone, including other schools in the world. Classes in New York could work on projects with classes in India, and then 3D print their final results in both locations. There are many unique forms of art that have come about in the past few years through the use of 3D printing, but we have not even begun to scratch the surface of what is possible.

- Medicine - 3D printed organ models are becoming increasingly common in hospitals and clinics as a way for surgeons to plan operations before operating, but they also allow medical students and professionals alike to study the human body – and all of its

quirks and malfunctions – more closely and thoroughly than ever before.

3D printed multi-material models can replicate the complexity and wide range of patient pathology, making them superior tools for medical education. In multiple peer reviews, users agree they can be an invaluable asset to training and better prepare practitioners for the clinical realm.

3D printing provides several features that can revolutionize education:

• It provides teachers with 3 dimensional visual aids that they can use in their classroom particularly in illustrating a hard to grasp concept;

• 3D printers make it easy for teachers to seize the interest of their students compared to just showing the pictorial representations of objects;

• It enhances hands-on learning and learning by doing. Using this prototyping technology, students will be able to produce realistic 3 dimensional mini-models (great for engineering, architecture, and multi-media arts students);

• It provides more room for interactive class activities. In biology, for instance, teachers can create a 3D model of the human heart, head, skeleton, to teach students about the human body.

Based on the article in "3d printing industry" from January, 2016, The Hungarian '3DTECH in Schools' program takes a huge leap forward by welcoming CrafUnique, Hungarian 3D printer manufacturer and Leopoly, online 3D modeling software developer on board. With this turn the program awards another 10 Hungarian schools with a 3D printer which adds up to 21 institutions equipped with innovative technology due to the initiative. The 3DTECH in Schools program unites 3 of the most important companies in the Hungarian 3D printing scene. The goal of the project is to install 3D printers in every Hungarian educational institution within 3 years. They'd also like to ensure that the technology is adopted so that it is helping the development of the students and the work of the teachers efficiently.

IV.   CONCLUSION

The use of 3D printing in colleges and universities is helping to nurture creativity and satisfy intellectual curiosity among students. Just as important, the fast-paced prototyping cycle made possible by industry-grade 3D printers is preparing students for the real world. They can develop their ideas rapidly, bring their designs to life quickly, integrate combinations of materials that may never have been tried before, and create amazing objects that model the innovations with high accuracy, fine detail and moving parts. Nobody can predict the overall impact of 3D printing on higher education. But if the transformation taking place in these schools and others like them is any indication, learning will never be the same.

That authentic experience can spark the learner's imagination, encourage them to persist in the face of setback, and gain confidence as problem-solvers, while helping them think, design and build. Those are disciplines we want for every student.

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THEORETICAL AND METHODOLOGICAL QUESTIONS OF CONTEMPORARY PEDAGOGY

Increasing the Effectiveness of the Educational Process in Technical Sciencess by Modern Information Technologies

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Abstract - **This report examined and compared the methods related to evaluating students' knowledge by classical tests as well by the computer test system "UniTeSys". In order to verify the effectiveness of the evaluation by computer tests a series of experiments was conducted. Statistical processing of the results from the tests of students in the discipline Technical Documentation was made. In conclusion it can be said that the objective of this work was achieved, namely to demonstrate the effectiveness of the assessment of students through computer tests in technical disciplines. By choosing the computer test system "UniTeSys" the right choice of productive educational technology assessment was made, which increased the effectiveness of training and evaluating through the use of computer programs.**

I. INTRODUCTION

When planning the pedagogical experiment hypothesis was devised that includes the basic idea whose authenticity needs to be verified by conducting the experiment.

The hypothesis of the study is:

"The computer test system UniTeSys used for evaluating students' knowledge in engineering courses will lead to a greater efficiency of the evaluation on the one hand and to higher level of understanding the material on the other hand"..

II. RESEARCH PLAN

The stages for conducting the educational research area preparatory stage, a preliminary study, main study (natural and controlled experiment) and final experiment.

A. Preparatory stage

In the preparatory stage along with the study of the literature and the development of a concept is considered in what way the didactic experiment will be held, the key points in the methodology were marked.

The purpose of this stage is mainly gathering information about the suitability of the designated for the didactic experiment methods and tools.

Purpose of the preparatory stage is also specification of the methodology and the organization of the work in the next stage.

B. Preliminary study

In this stage:

- the primary system (bank) of questions and problems was developed;

- pilot testing was conducted in which the assignments of the primary version of the test were tested;

- an analysis of the quality of questions;

- the difficulty of the assignments was analyzed;

- an analysis of the distractors was made;

- the test was tested and revised.

To establish the extent of conformity between the test assignments and the predetermined goal for the needs of the research an expert assessment was made.

The method of the expert assessment was applied twice. Once in defining the validity of the content of the compiled didactic tests and a second time in researching the experts opinion for establishing the conformity of the test assignments with certain parameters.

The expert assessment of the test assignments is an essential premise for creating tests regardless of the level of application. Once the assignments are prepared their objectivity and their accuracy of the formulation should be checked. A task or a question can be considered objective or correctly formulated if the opinion of most experts match.

The analysis of the content validity of the test assignments by the expert assessment shows a high degree of conformity between the test assignment

and the predetermined goal whose achievement it is intended to measure.

It is considered that the test is valid and it can be used to evaluate the students' knowledge.

After examining and developing the test assignments and considering the results of the expertise it goes to the next stage of the test development: arranging the assignments and conducting their approbation.

According to the approbation results some of the assignments have been removed.

During the preliminary "trial" experiment, in order to approbate the methodological apparatus, the central tendencies and the standard deviation for the entire experimental group have been calculated. The results are shown in Table 1.

TABLE I.   CENTRAL TENDENCY

Statistics	Value
Aarithmetic mean /Sr_ar_s/ $\overline{X}$	3,9793
Harmonic mean value /Sr_ha_s //Xh/	3,7327
Median /Med/ /Me/	3,9862
Mode / Mo/	4,00
Asymmetry coefficient tin K.Pirsan / S_1/	-0,0214
Asymmetry coefficient in Dzh.Yul / S_2/	-0,0214
Excess /E/	-1,3439

The results of the test measurement in the prior study were calculated using the formulas established in the testing by the test system "UniTeSys".[1]

The analysis of the results of the preliminary study gives a reason to conclude that the test system "UniTeSys" is suitable for the main experiment and with its help the goal will be achieved.

C. Natural experiment

During this study the initial natural experiment for the control and the experimental groups took place. This experiment was conducted by the pedagogical diagnostics through accepted indicators for measuring students' achievements in each of the two groups.

The aim of the natural experiment was to determine the effectiveness of the developed system.

In this stage following tasks were completed:

- A final selection of the assignments, the questions and the arrangement of test tasks was made;

- An experimental verification of the developed test assignments, methods of work organization of the students was conducted;

- The content of the used computer tests was analyzed;

- An experimental verification of the conformity between the electronic and the conventional tests in the education of students in technical disciplines was conducted;

- The results of the didactic experiment, support for the hypothesis, were summarized.

The results of the tests in the control and the experimental group are presented infigure.1.
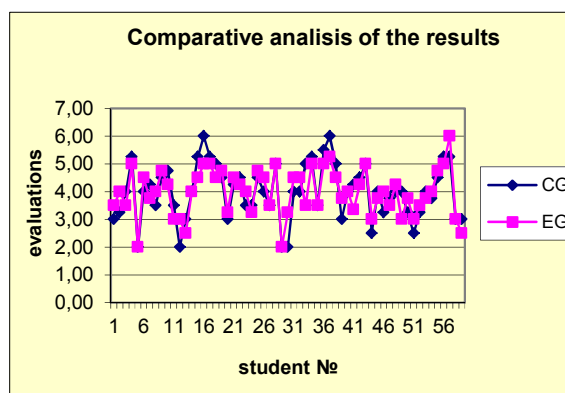
Figure 1. Results of the tests performed in the control and the experimental group

D. Testing the hypothesis

Testing the hypotheses implies estimation whether a predefined parameter value is plausible, i.e. concluding if the information obtained in the sample conforms to the expectations. In this way a decision whether to support or disprove the hypothesis can be made based on the results of the observations.

To solve the problem following hypotheses are formulated:

Ho: µ1-µ2 = 0 - Between the level of knowledge acquired in both groups there is no significant difference;

On: µ1-µ2> 0. 0 - Between the level of acquired knowledge in the two groups there is a significant difference;

For finding the test statistic and its critical values with predetermined level of significance a t-Test was applied, the results of which are presented in Table 2.

TABLE II.   Two-Sample Assuming Unequal Variances

t-Test: Two-Sample Assuming Unequal Variances	Variable 1 /CG/	Variable 2 /EG/
Mean	3,983050	3,9762711
Variance	0,986776	0,7017548
Observations	59	59
Hypothesized Mean Difference	0	
Df	113	
t Stat	0,040075	
P(T<=t) one-tail	0,484051	
t Critical one-tail	1,658450	
P(T<=t) two-tail	0,968103	
t Critical two-tail	1,981180	

Conclusions:

- As shown by the test statistics results / t Stat = 0,04007554 / does not exceed the critical value for a one-sided test / t Critical two-tail = 0,9681 /, therefore the null hypothesis is not disproved. This means that it can be assumed that between the level of education of the students from both groups there is no statistically significant difference at the significance level of 0.05.

- The innovative electronic tests for verifying and evaluating the knowledge of the students in technical disciplines are equivalent and comparable to conventional methods

- The test is valid because it leads to results that are comparable with the results of a similar measurement method / have similar results /.

- The test is reliable because in the two groups of students with the same level of competence the results are similar.

E. Controlled experiment

As obtaining data on approximately equal performance of the experimental and control groups began forming experiment. It includes a special impact on certain qualities of the students. Quantitative and qualitative analysis of the results of the survey was made.

In this stage following assignments were accomplished:

- In the experimental group two intermediate tests were conducted;

- In the experimental and control group were conducted final tests;

- Surveys were conducted to measure the effectiveness of the evaluation of computer-based testing;

- A comparison between the results obtained from the tests in the study was made;

- An experimental verification of the effectiveness of the method of evaluating the computerized test system was made;

- The results of the research in the learning process were implemented.

In this phase of the study were used quantitative methods, in which parameters of the study experiments were set in advance before their implementation as well as qualitative methods, through which the parameters themselves were sought and interpreted [2].

The study used interviews and written questionnaires because of their wide applicability in the teaching practice.

An analysis and research of expert's and students' opinion was made on the effectiveness of computer-based test evaluation, on the quality of education, on the need to improve the learning process including recommendations to the teaching, training and the teaching staff.

F. Final natural experiment

The purpose of the final natural experiment is:

- Accomplishing a series of final tests to measure the final results of the survey conducted in all groups of the study;

- Providing information on the results of the education, the methods that have been experimented under accordingly variable conditions;

- Comparison of the results by groups and variants derived from the preliminary, the intermediate and other tests during the study ;

- Experimental verification of the effectiveness of the method of operation or the suitability of the learning content.

- Implementation of the survey results.

G. Conducting final tests and processing the results.

The final test was conducted in the experimental and in the control groups. The results are shown in Figures: 2, 3and 4.
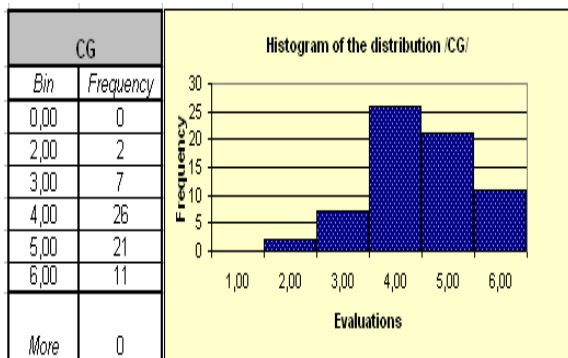
Figure 2. Frequency distribution and histogram of the results of the control group
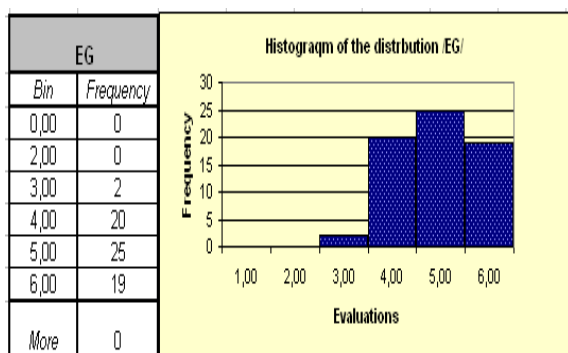
Figure 3. Frequency distribution and histogram of the results of theexperimental group
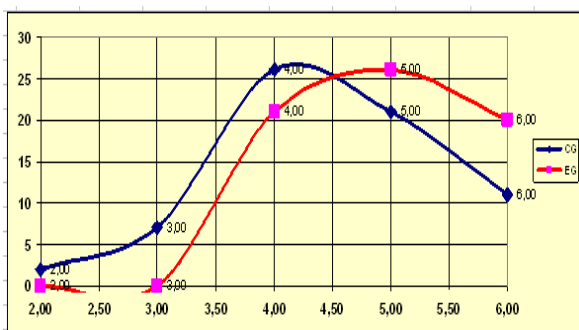
Figure 4. Distribution of the results of the control and experimental group

The results of the experimental group were statistically significantly better. In applying the method of parametric t-test to check the alternative hypothesis, the field of adoption is one-sided and the probability of error is estimated as:a =0.05. To find the test statistic and its critical values at a predetermined level of significance P = 0,05 t-Test is applied: Two-Sample Assuming Unequal Variances, whose results are indicated in Table 3.

TABLE III.   TWO-SAMPLE ASSUMING UNEQUAL VARIANCES

t-Test: Two-Sample Assuming Unequal Variances		
	Variable1 **/CG/**	*Variable 2* **/EG/**
Mean / μ / $\overline{X}$ /	4,018358209	4,48119403
Variance /σ^2/S^2/	0,852786658	0,40407431
Observations	67	67
Hypothesized Mean Difference	0	
df	117	
t Stat	-3,379253289	
P(T<=t) one-tail	0,000494038	
t Critical one-tail	1,657981659	
P(T<=t) two-tail	0,000988077	
t Critical two-tail	1,980447532	

Since t Stat = - 3,379253289 <1,980447532 / t Critical two-tail /, then the test statistic is outside of the field of adoption andt he null hypothesisH0 is rejected in favor of the alternative. This is confirmed also by the probability: P =0.00099<0.05.

As a result it can be concluded that the computer test is more effective for evaluating students in technical disciplines.

The results protocol which the "UniTeSys" system generates by teachers' request can be used for comparison of the results.The data from the survey can be used to evaluate the test subjects and to conduct a further statistical analysis of the obtained results. The system offers the possibility to display the data in text, tables and graphs.

III.   CONCLUSION

In conclusion it can be said that the objective of this work, namely to demonstrate the effectiveness of evaluating students through computer tests in technical disciplines has been achieved.

By choosing the computer test system "UniTeSys" the right choice of productive educational assessment technology has been made, which increased the effectiveness of educating and evaluating through the use of computer programs.

Based on the implemented empirical research, from the qualitative and quantitative analysis of the results following conclusions and generalizations can be drawn:

- The study content of technical disciplines offers great opportunities to build different versions of computer teaching tests and their use in individual and differentiated work with students.

- Several tools allow to obtain reliable data on the actual level of knowledge and practical skills of the students surveyed.

- Based on the comparative analysis of the results of the didactic study is reasonable to assume that the computer test system leads to a full and lasting understanding of the material, activates the students' cognitive and practical activity and increases their success rate.

- Testing using computer based testing environment ensures a reliable, objective evaluation and application of the same criteria for testing each student.

- Once created and standardized the computer tests can be reused, shared and / or exchanged between different teachers and e-courses.

- Through generated electronic tests can be created and maintained dynamic test packages in multiple areas much faster (compared to traditional approaches)

- Trainees receive faster assessments on the progress of their improvement in studying.

- Computerized tests are an effective way to implement the vetting and evaluating activity as they show the degree of mastering the educational minimum of the educational content with maximum efficiency and minimum consumption of resources and time.

The introduction of computer-based testing methods for evaluating students in technical disciplines, developed for specific educational content and theoretical and practical system of learning tasks, increases the efficiency of their activities in the acquisition of knowledge, skills and habits, and their creative application. The results of the study show that in the context of developing a system of classes and teaching model for acquiring knowledge the organized education of students contributes to improving the education of future professionals [3].

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Introduction of Kanban Methodology and Its Usage in Software development

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Abstract – The purpose of this paper is to introduce Kanban methodology and present it as a tool for project management in software development. Kanban was originally invented as a tool of Lean Manufacturing, but its usage has proven to be useful in many other areas like software engineering. The usage of Kanban in software development is increasingly growing, as the traditional methods are replaced with new much more flexible methods. The implementation of Kanban in software development brings many advantages and benefits. Flexibility, increased productivity and efficiency are only a few benefits of its implementation. Kanban is a Japanese term meaning signboard or graphic and a way for teams and organizations to visualize their work, identify and eliminate bottlenecks and achieve operational improvements in terms of throughput and quality.

I. INTRODUCTION

If we want to understand Kanban and use it as a tool in software engineering we first need to understand its origin. Kanban gains its roots in the production system of Toyota. The main goal of Toyota was to overcome its competitors by producing cars for the same or lower price from the competition, but with better quality. Toyota production system (TPS) is also known as Just-in-time (JIT) manufacturing and the basic principle is to produce "only what is needed, when it is needed and in the amount needed".

The Kanban system is also known as "Supermarket method" because the main idea is borrowed from the work of the supermarkets. The idea of using this method originally came from Kiichero Toyoda the founder of Toyota Motor Company, but Taiichi Ohno, a former vice president of Toyota, was the responsible for developing the strategy and implementing it in the production. The supermarket stock has the items needed by its customers, in the quantity needed and they are available for sale at any time. By using Kanban they minimized the work in progress between processes and reduced the costs associated with holding an inventory.
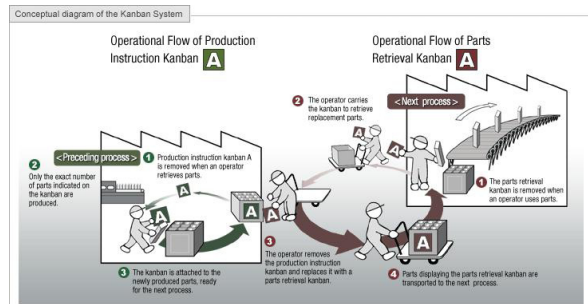
Figure 1. Conceptual diagram of the Kanban System

Fig. 1 shows two kind of Kanban system used for managing parts, the production instruction kanban and the parts retrieval kanban (Toyota Global, May 2016).

The term Kanban is also associated with the term Lean management. Lean management is an approach of running an organization that implements the concept of continuous improvements, a long term approach of work that systematically seeks to achieve small, incremental changes in processes in order to improve efficiency and quality. Lean management tries to eliminate any waste of time, work or money by identifying steps in a business process, revising them and cutting them if they do not create value. The term lean management in software engineering was first mentioned in the book "Lean Software Development" by M. Poppendieck and T. Poppendieck, 2003. In this book they defined the main lean principles:

- Eliminate waste
- Amplify learning
- Decide as late as possible
- Deliver as fast as possible
- Empower the team
- Build integrity in
- See the whole

These same principles are emerged as agile software development.

This paper is going to explain the Kanban methodology, compare it with traditional methods, and show the implementation of Kanban in software development and its benefits.

II. COMPARISON OF TRADITIONAL DEVELOPMENT METHODS AND AGILE METHODS

Software systems are developed so they can perform complex tasks on the demand of a user. This process of building a software needs attention to details in order to meet the customer's needs. The traditional method is characterized as a series of steps like requirement, definition, implementation, testing, deployment et al. First, the customer's demands are carefully documented, the software visualization is made and then the actual coding has begun. After these steps there are various types of testing before the software meets final deployment. The main idea of traditional development methods is to have detailed visualization of the project before the building even starts.

While the traditional methods require the user to have detailed requirements of the software, agile methods are more flexible. The agile methods are based on adaptive software development methods, while traditional methods (e.g. waterfall model) are based on a predictive approach. The agile methods are incremental and iterative, and the actual users are always there to suggest improvements and review every phase of the project. The increased customer involvement in the development of the software makes changes to be easily made and keeps the customer satisfied. The adaptive approach of the agile methods has no detailed planning, but only future tasks defined by the characteristics that must be developed. The product that is developed is frequently tested and that minimizes the risk of major faults in the future tasks.

Some of the most used agile methodologies are: Extreme Programming (XP), Scrum, Kanban, Feature Driven Development (FDD), Dynamic System Development Methods (DSDM), Adaptive Software Development (ASD) etc.

In February 2001, seventeen representatives from different agile methods formed the Agile Alliance. The purpose of this alliance was to promote their views, so they grouped them together into a workable framework named Agile Manifesto. The result from this work was:

- Self-organization and motivation

- Working software is more useful than overall excessive documentation

- Continuous customer involvement

- Quick responses to change

III. KANBAN IN SOFTWARE DEVELOPMENT

In the Japanese Dictionary "kan" means "signal", while "ban" means "card" or "board". Kanban card is a signal that needs to initiate action and suggests manufacturing of parts in "pull" production system invented and developed as part of the production system of Toyota. Accordingly Kanban refers to "signal cards" which signals the need for a particular product. Taiichi Ohno had the idea for Kanban when he visited an American supermarket, where the shelfs are amended when the amount is reduced to some extent (pull mechanism).

In the manufacturing industry, Kanban has spread worldwide as a tool of line production (Lean Manufacturing), and in agile development of software products is a way of visualizing the project presented on cards with problems on the board, which achieve "just in time" (just in time - JIT) strategy to develop a software product.

Kanban focuses more on work to be carried out on time instead of focusing on who did what. People work together, but they don't work at the same speed, do not have the same knowledge and skills and must be synchronized. In Kanban, the work is organized in tasks or processes and allows team members to self-detect the workflow in the most efficient way. Kanban rules are such that we don't need to consider the requests of the software product we don't need immediately. We no longer need to write specifications, but only what can be developed. We no longer need to develop more than can be tested, tested more than can be deployed.

Kanban system in software engineering looks like work waiting in line and it passes through the phases until it is completed. When the work phase is completed, then it goes into another phase.

Kanban method in software engineering was defined and enhanced by David Anderson. In his book, "Kanban: Successful Evolutionary Change for Your Technology Business", David Anderson identified five core properties in successful implementations of the Kanban method:

- Visualize the workflow

- Limit WIP (Work in progress)

- Manage flow

- Make Process Policies Explicit

- Improve Collaboratively

The most common way to visualize our workflow is to use a board on the wall with sticky notes and columns. Each column on the board represents a step in our workflow, and each sticky note a task. To show the work in progress of a project, D. Anderson uses a virtual Kanban board.
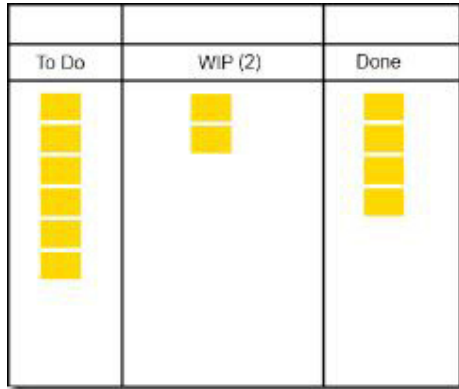
Figure 2. Simple Virtual Kanban Board

By creating a visual model of the workflow we can observe the flow of the work through the Kanban system. By limiting the unfinished work in progress we can reduce the time the task needs to move through the Kanban system. This can avoid problems like task switching and reduce prioritizing task.

By using work in progress limits, we can optimize the Kanban system to improve the smooth flow of work, collect metrics to analyze the flow, and even get indicators of future problems by analyzing the flow of work.
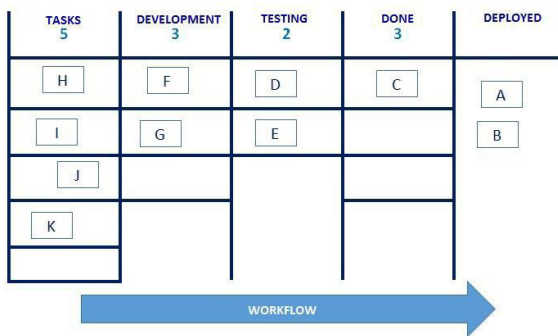
Figure 3. Kanban workflow board with limitations

IV. CONCLUSION

Each software development method has its own advantages and disadvantages. Each project has its needs and each different method can come with a different results. The traditional methods are often replaced with agile development methods mainly because of their flexibility and response time, but

agile methods can't guarantee success if the implemented method doesn't meet the needs of the environment.

Kanban is one of the agile methods that we can implement it successfully with the right effort and knowledge of our environment. During a development of a software product there are so many changes and sometimes it's hard for the development team to define the process. Some predefined set of steps may not lead to the desired result, since the software development process is a human activity that leads to problems with changing the customer requirements, changes in technology and developers etc. In other words, the variability of the process is very high. The one thing that is important to all methodologies is the importance of the people and their role in the process.

The focus of the Kanban method isn't to be agile methodology for software development which can lead to success, but Kanban focuses on the success of the software product and that process may result in that Kanban is an agile method. Kanban is highly flexible but at the same time there are clearly defined rules regulating the process.

The delivery of the software product with less possible errors and on time is the main goal of each methodology and therefore defines bandwidth that enables the prediction of future opportunities based on knowledge and experience. The bandwidth is the rate of delivery of the order to the customer in which Kanban determines two main variables: time cycle and limit the operation of the process. By the time cycle, limiting the work in process is also a variable that determines the bandwidth of the system. Through proper and smart defined limits in the columns, we avoid poor productivity that occurs because of too small restrictions.

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Pros and Cons of Software Development Task Sharing between Teaching Subjects

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Abstract - It is disputable, whether it is a good educational strategy to share one task between several teaching subjects. The usability might be different in different areas and levels of education. As we are now in the situation that we can compare the past separation strategies to the current sharing trend in a selected part of our curricula, we dedicate this paper to state a short early evaluation. Early, because the whole impact will be visible and measurable in 5-6 years. Short, because we focus on selected visible properties, without diving behind the cause. The subject of the evaluation and our conclusions is the teaching subject related to software engineering fundamentals, which became shared between several other subjects.

I. INTRODUCTION

As we already presented in our previous papers [1] and [2], there were huge modifications introduced into our Informatics curricula on both Bachelor and Master level. First kinds of these changes were renewed subjects, other completely new ones.

A new and very disputable phenomenon is included with this new curriculum, namely sharing a task between parallel subjects. Despite of the good practice defining continuous realization of tasks during several semesters at different but related subjects, in this case a significant problem occurs that different teachers have to evaluate students' work at different subjects in parallel. We devote this paper to the presentation of details of the problem and its comparison to the classical proven approach.

At this place, we would also like to express that the system of sharing tasks between subjects caused students to fail at related subjects already in its first year of application. As it was partially because of the worse health condition of a student that she did miss a deadline, the discussions are in place and improvements should be made to avoid such situations; for example, extending the concept of sharing by the system of a consolation path to the

final grading.

Returning to the topic, the aim of this paper is to present the problems related to the situation that arose during the first implementation of a curricula using significant sharing of programming and/or software development tasks between various parallel subjects.

In the next section, the problems are expressed. The two following sections after it are devoted to the analysis and separation of experienced properties into the categories and subcategories of pro and contra. We close the paper with an evaluation positioning subcategories against themselves and stating a final evaluation of pros and cons of software development task sharing between teaching subjects.

II. PROBLEM DESCRIPTION

We identified during the first year of implementation several problems we describe in this section. For the single task sharing we had to use two electronic systems dedicated to support the learning process. The sharing did not eliminate the duplicity in evaluation and grading, which reflected on both teachers' and students' side into problems or benefits depending on the luck and prior knowledge of the students attending the courses.

A. Two electronic supporting systems

To support the courses electronically, the definition included besides the quality LMS Moodle [3] the usage of a local academic project result.

Moodle LMS fulfills all requirements for an electronic supporting system of university education, including task definition and evaluation [4], possibility of integration with any standard service oriented software application, study material sharing [5], etc.

But, the subject implementations were extended by a seconding system (patchily aimed as the prime one) that contained a structured presentation of the learning material, which could be presented within

Figure 1.   Seconding learning supporting system menu including a link to Moodle LMS

Moodle as well by less teacher workload. The redundancy achieved by the introduction of the seconding system (see Fig. 1 and Fig. 2) and their interconnection aimed to let the students study the material twice and also allow them besides authorized access vie Moodle an unauthorized direct access to these materials.

B. One shared task

One shared task was aimed to force the students to work in a single application domain while completely developing software. The subjects sharing the task were related to particular subtasks or groups of subtasks. As these subtasks are tied together and by their principle cannot be

implemented in parallel, this obviously caused smaller or larger problems with catching the deadlines for the particular subjects, or even with defining them in a way that partially eliminates disadvantages of the equality principle.

C. Students' experience at the labs

Students experienced a better overview on the software development task at the beginning of the semester due to the multiple explanations by different teachers at different subjects. It seems that lots of them welcomed the idea, but they understood it, as it was the same task for all subjects. Later, during the semester they started to realize that the requirements differ by subject; and that each subject has defined different deadlines for submission. These deadlines were synchronized at theoretical level, but students had to experience that in the case one is late with a single deadline at one subject he will be highly probably late at the other subjects as well. Very often the first minutes of a lab session were about passing the deadline expectations of a related subject instead of starting to solve the exercises for the current lab.

D. Teachers' experience at the labs

Numerous students were thinking that a shared task will make their life easier, but later during the semester they started to consult the teachers of one subject on how to solve the subtask of the related subject with aim to meet the criteria from that other subject. Teachers' workload increased but this was only indirectly related to subtasks to be solved in the frame of their subject. Teachers also had a bad experience when evaluating the students, namely with a number of students missing the deadlines or delivering incomplete solutions. Just in time checking showed that the majority of the students is unable to solve tasks more than a week before deadline because of the organization of some specific subjects (please refer to Fig. 2, where you

Figure 2.   Incomplete table of contents in the seconding system breaking the redundancy principle and making this system to the prime system

can find missing content – the subtasks were not visible to the students in a reasonable advance.

E. Common mistakes have different weight at different subjects

An excellent example problem was that while some mistakes could be tolerated within the frame of one subject, the other subject was requiring their fulfillment on exact deadline.

Students could not organize their work or even optimize it based on their actual knowledge and time, sometimes a mistake they could not find a solution for caused that the subtask realization was late to the deadline. According to the relevance to the subject and deadline, weight of such mistakes might of might not effect the students' evaluation. In the case of critical effect, the teacher had to react and reconsider the value and importance of such weights of mistakes.

F. Evaluation at the end of the semester

All mistakes and deadline misses were indicating that at the end of the semester there will be a problem for many students to deliver their solutions in the expected size and quality.

For a single subject, it would be possible to identify specific reasons for groups of students, but now we can rely only on their comments that were related to deadlines from the other subject.

To provide measures, we propose the evaluation based on the (from both the teachers' and the students' point of view) most visible property. This is the number of students who passed the grading in the specific week devoted to it. Additionally, we can provide the number of those students as well who passed the first exam too at this period of time.

The total number of enrolled students with the selected subject Software Engineering Basics was 290. Of this number, 31 students representing 10.7% of the total number of students failed to fulfill the basic requirements, i.e. failed the subject without reaching the prerequisites to attend the exam. Another 51 students asked for deadline prolongation – this number represents 17.6% of the total count of students; these students might deliver the final solution for evaluation one week after the last deadline.

Of the 203 students at the subject Evolution of Software Systems, the performance of the 43 students not having the shared task to the other subject was predictable and stable. In comparison to the other 162 students starting with a more advanced knowledge, the absence of the shared task produced excellent working environment for ensuring equity by the pass point of the subject.

III. Pros

The advantages of the presented kind of curricula extension we identified are significant. We have to mention the following 5 advantages divided into 3 categories:

- Category one – the task as it is:
  - There is one large task, defined and consulted by mere teachers that can be understood very well.
  - The final goal is known at the beginning. All work aims to fill this goal during the semester and students do not need to change their focus on other goals.
- Category two – work on the task:
  - Continuous and incremental work supports self-awareness of students by the particular achievements.
  - Redundancy of information increases accessibility; different formulations of the information increase the level of comprehension of the task goals and deadline passing criteria.
- Category three – evaluation and feelings:
  - During evaluation, the formula is positive to the students, because it considers a single success to be a multiple success distributed as single successes to different subjects. One successful task implementation ensures several positive grades for each student.

As it is visible from the above evaluation, for the task we identified 2 advantages, for implementation another 2 ones, and for task evaluation a single advantage.

IV. Cons

The disadvantages of the presented kind of curricula extension we identified are significant too. We have to mention the following 7 disadvantages divided into the same 3 categories as defined for the advantages above:

- Category one – the task as it is:
  - Looking at the task definition and requirements, its size and coverage are just minimal. It means that the required workload on the students is really low when compared to the amount of credits they earn by the task implementation. Not even two full working ours produce a credit!

o Working just in one domain makes the task monotone. As side effect, the students' level of creativity significantly decreases, as does the level of motivation. Many students look at the subtasks as a must and they do not invent any effort into perfection.

- Category two – work on the task:

    o Using of more than one source of information led to confusion of students, but teachers' conflicts as well. The redundancy was not kept as redundancy – just in time changes were made without informing the other related subjects about a change on time. A group of students relied on a single source of information they choose without asking the teacher, so the teacher had low information about the channels really followed by his students. It is always an extra workload to maintain redundancy, and in this case this redundancy was aimed to support the information sharing only.

    o When students hade to submit results of subtasks, a group of them did not recognize which results belong to which subject implementation. This cacophony confused the students on one hand-side, where the majority decided to submit more than expected. On the teachers' side these extras (i.e. when there was more submitted than expected) were also sources of problems. "Are these extras wanted or just unwanted things that should be reflected in the evaluation?" Teachers had to face this question time after time.

- Category three – evaluation and feelings:

    o Teachers stuck with evaluation due to the question mentioned above. A good teacher tells his students what is required for his subject, but as students submitted to all subjects in the same time, they had to change almost all submissions, as evaluation should not be shared between tasks at all.

    o Students stuck due their previous mistakes. A mistake identified at one subject had consequences into submissions at other subjects as well. As mentioned above, their major feeling was that they cannot catch the deadlines, so they did a work for a specific subject also at the labs of the other subject.

o The worst effect of task sharing was that during evaluation a single mistake could affect multiple fails. Several students gave up the whole task because they failed at a single subject in the sharing matrix as it was obvious that they cannot continue their study failing any of the subjects.

As it is visible from the above evaluation, for the task we identified 2 disadvantages, for implementation another 2 ones, and for task evaluation 3 disadvantages.

V. CONCLUSION

To conclude our findings, we have to look at the phenomenon of software development task sharing by the defined categories and in general as well.

First, we have to state that the proposed system is working but unfriendly to students in terms of equity. We need a longer analysis to ensure the quality of fulfillment of requirements for equality, which could be one of the next research topics in future. One should better identify critical subjects and for these critical subjects there should be no task sharing, or if yes, these subjects should be merged. A consolation path should also exist for weaker or slower students, for example in the way that the consolation path includes obligatory, to the subject private task implementations, fulfillment of those ensures the minimal grade. Then, the results of the shared task are required to any better grade or to eliminate losses when implementing the consolation path task.

Going deeper into evaluation of the task sharing, we see that the first two categories related to task definition and task implementation have in equal advantages and disadvantages. In terms of comparison score, both categories end up with 2:2. The third category related to evaluation and feelings of students shows a significant difference. Here, disadvantages overrule advantages by 3:1.

For an overall comparison, we sum up the results by categories. First, we state the order of evaluation scores as defined in the title of this paper, namely Pros: Cons. In terms of this definition we evaluated the following scores:

Category one – 2 : 2.

Category two – 2 : 2.

Category three – 1 : 3.

Total – 5 : 7, after (2:2, 2:2, 1:3), means that we found less advantages than disadvantages at the defined levels of comparison.

We have to mention here that this evaluation is based on a single years' experience only. As subjects are continuously improved, to prove these results we will need to repeat our measurements in the following five years too. Just then we will be able to make general conclusions for or against the application of software development task sharing between different teaching subjects. Unfortunately, by that time there could be an also significant number of students that failed because of the error in the concept. This is a very high price to be paid, but we hope the continuous improvements will introduce changes to avoid the losing of such amount of students due conceptual errors in the curricula.

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University Education in 21 century: Student Attitudes toward High Educational Programs in Macedonia

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Abstract - **This paper is based on two surveys conducted in 2013 and 2014 on Goce Delchev University in Shtip, Republic of Macedonia. The importance of implementation of reforms in high education system depends on the dynamics of their implementation. In the case of Macedonia, the intensity of those reforms should create better conditions for the students in the possibility of gaining more cumulative knowledge. From the empirical data we can notice that the main problem is on practical involvement of students in teaching curricula's, communication with teaching and administrative staff and the access to the libraries and literature in general. The students also have different attitudes toward preference of the form of the exams. But the biggest problem which can be located is in low student exchange rate in using European programs and implementation of this segment of United Credit Transfer System.**

I. INTRODUCTION

The role of education in 21st century is to provide future intellectuals in the countries which can serve as a buster for further social developments. Educational reforms are the core of this future development. In this sense the implementation of ECTS can serve as a base for student mobility, but also and as possibility for generating new teaching methods and knowledge in the age of globalization.

This paper is based on two surveys conducted in Faculty of Law in Shtip in 2013 and 2014. The goal of the research was to analyses students attitudes toward questions related with the students status and perceptions. The first research was focused on the attitudes of students of University "Goce Delchev" in Shtip and high school students, and the second one was focused on wider student population in Republic of Macedonia. Both surveys included approximately 300 persons. In the both researches there is gender balance, different social and ethnic status, but most of the included persons are from urban areas.

II. RESULTS OF THE RESEARCH

In the first research we are tracking the motives for involvement of the future and present students in high educational programs and Universities in general. On the question, Which are your motives for choosing your university or high school?, for the university students this is the personal choice, which makes them more autonomous in the choice (Fig. 1), but surprising is the attitude of the high school students in which together with autonomy we can notice and rationality of choosing their future profession i.e. they are equally motivated by the possibility of future employment and their predispositions or talent (Fig. 2).
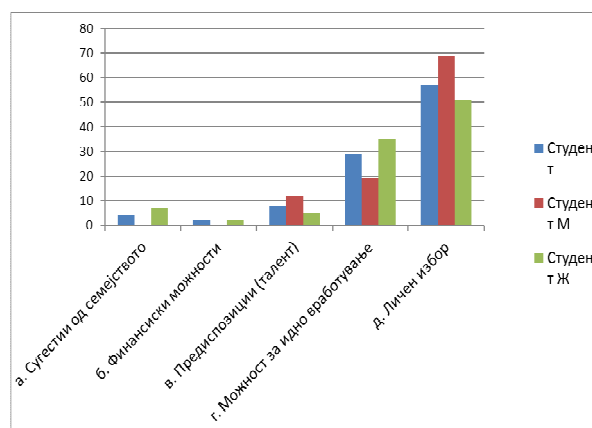
Figure 1: University students
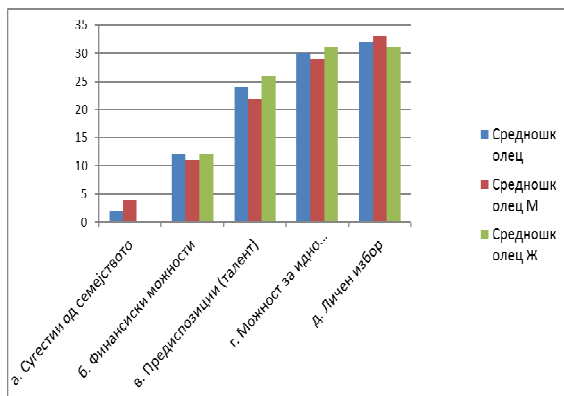
Figure 2: High school students

We also can notice that high school students are more optimistic about future employment than the university students (Fig. 3 and Fig. 4). More university students on the question "Do you expect that after finishing your studies you can find work?" answered with maybe, but high school students on the same question answered with yes and maybe.
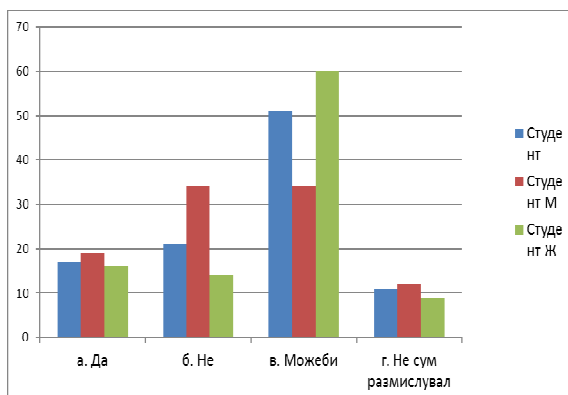
Figure 3: University students on the question: Do you expect that after finishing your studies you can find work?
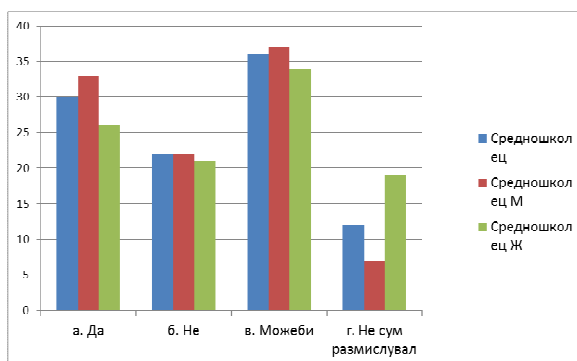
Figure 4: High school students on the question: Do you expect that after finishing your studies you can find work?

From the results we can also notice strong gender division on the question of their future profession. For example males prefer to be engineers, politicians and doctors, and females prefer their future profession to be related with law, professors or to be managers (Fig. 5).
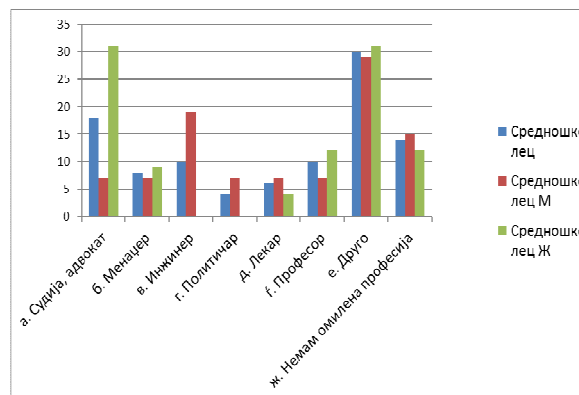
Figure 5: What is your favorite profession

Yet, the main problem of the Macedonian society, as in most transitional countries is the strong politicization. On the statement that the membership in political parties is precondition for future employment, most of the students fully or partly agreed, and only small number disagrees (Fig. 6).
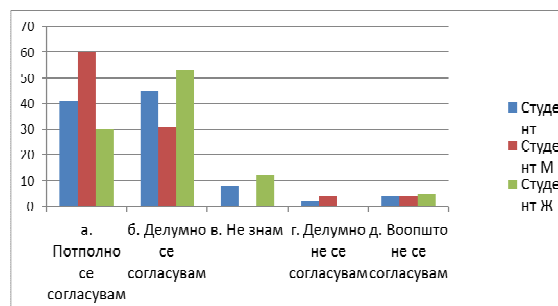
Figure 6: Membership in political parties is precondition for future employment

Students are having different opinions regarding the most influential factor of their studies. For them the most influential is the adjustments of study materials, related with teaching curricula's. On the second place by importance is greater level of practice during the studies and further are visiting the lectures and accessibility of the professors and assistants (Fig. 7). For the students of Goce Delcev University in Shtip the most important factor is greater level of practice, and for the students of Universities "Cirilus and Methodius" in Skopje and "Kliment Ohridski" in Bitola is the adjustments of study materials (Fig. 8). Regarding the average of the grades of the students, for most of them the

adjustment of the material is the most importance, except the students with mid average between 7 and 8 grades where practice is the most important. We can also notice that the best students prefer more communication with their assistants and professors (Fig. 9).
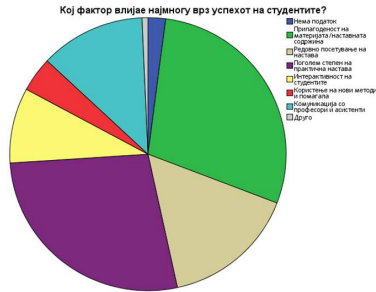
Figure 7: Whish is the most influential factor of the studies?
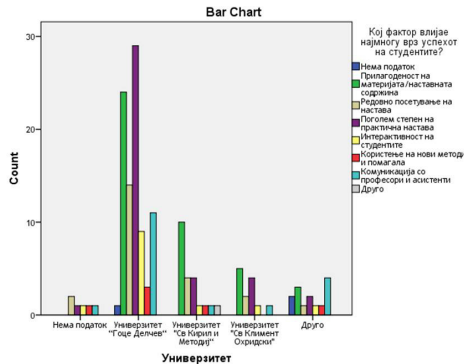
Figure 8: By Universities, Which is the most influential factor of the studies?
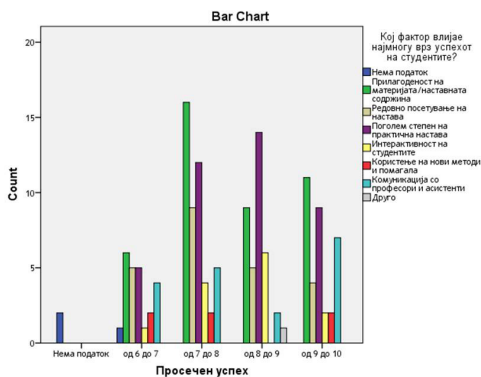
Figure 9 By Grades, Which is the most influential factor of the studies?

The students are partly satisfied of the conditions of their study (Fig. 10) and also with the grade they got for the passing different subjects (Fig. 11).
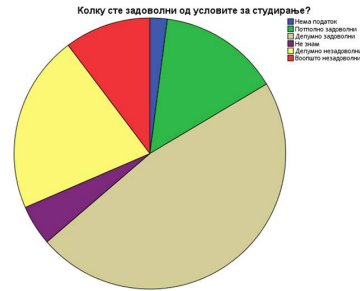
Figure 10: How satisfied are you of the conditions for study?
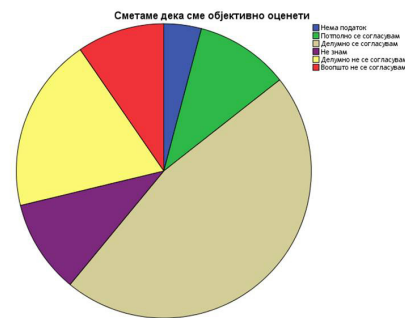
Figure 11: We think that the grades we got are objective

Asked about the form of the final exam the students are divided in their attitudes. Half of them prefer whiten exam and the other half oral final exam. By Universities, we can notice that the students of Goce Delchev University in Shtip prefer oral final exam and the students from Universities "Cirilus and Methodius" in Skopje and "Kliment Ohridski" in Bitola prefer written final exam.

On the issue of practical experience during the studies, we can notice that there is lack of it. Aldo there is division in the answers; the Universities in Macedonia should put more effort in this segment of the curricula's (Fig. 12). Yet, the most disturbing think is the lack of habits of the student to visit university libraries for their research papers. New informational technologies can serve as a tool for distance learning and research online from home, but the library experience is one of the key segments of study. Almost half of the students never went to the library, and one quarter of them is visiting university libraries only few times during the semester (Fig. 13).
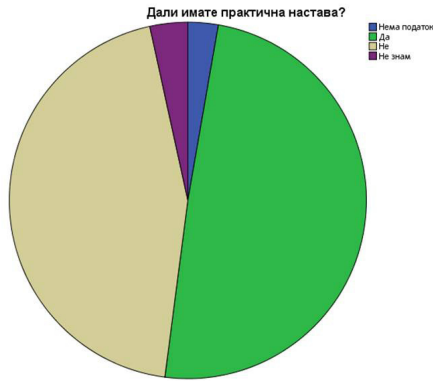
Figure 12: Do you have practice in your University?
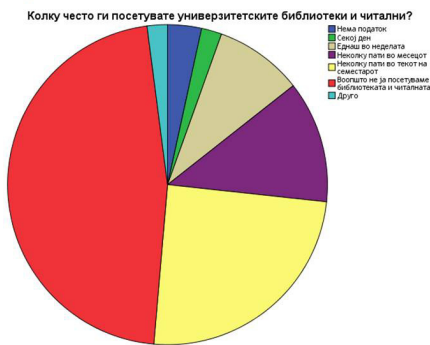
Figure 13: How often you are visiting the university libraries?

III. CONCLUSION

From conducted research we can conclude that ECTS is not well accepted in universities in our country. If for university students the motives for choosing their university is the personal choice, for surprising for high school students that is the possibility of future employment and their talent. Also can conclude that high school students are more optimistic about future employment and they think that they can do more in their lives, than the university students. We can also notice that the students are partly satisfied of the conditions of their study and also with the grade they got for the passing different subjects. The most disturbing think is the lack of habits of the student to visit university libraries for research and learning. Unfortunately, students more preferred to learn and investigate on internet from home instead of visiting libraries.

Our goal is to improve educational programs in universities in order to have more practical learning and better utilization of libraries. Also, we will try to reject the politics as precondition for future employment in order to have a better education.

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On Thesis Supervision Experience in a Slightly not Native Environment

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Abstract - Agile software development methods are often characterized as the best methods of rapid development. Without considering the size of the project, only focusing on the time spent for developing an acceptable solution is this statement in place. When applying the statement on development tasks included with a diploma thesis, it obviously implies that agile methods are the better choice. This paper is aimed to present a discussion on the above statements. This discussion is presented in the environment where writing of the thesis itself is defined as an iterative and incremental process with predefined milestones. The basis of the discussion comes from this paradox. We present our impressions based on our experiences in both Bachelor and Master levels of education.

I. INTRODUCTION

Diploma theses are results of application of learned knowledge of the students when implementing an appropriately large task at the end of their studies. This implementation usually takes two semesters, at our Department we add an extra semester for the Master level students. This addition is aimed to allow growth in task size, but more to provide an environment that ensures a better quality of the results. Most thesis topics from the industry require fast implementation; in the majority of these cases agile delivery is required. The extra semester is usually enough for pilot implementation, but sometimes the company defines other milestones of the development.

All these company-defined milestones are relevant to the evaluation of student activity in the extra semester, but for the last two semesters there are relevant the milestones defined by the Department. As a change in the organization complicates the implementation, we dedicate it as a problem we experience very often.

Working incrementally by iterations is an accepted development process, which we also try to integrate with the process of diploma thesis delivery. In this situation, one should not develop complicated

methods but let do inspired by an existing fast iterative process such agile delivery. This is what we declare we did.

Below in this paper you will find details on the thesis delivery process and see that it is iterative and incremental but not agile as milestones are hard ones, which cannot be postponed or reorganized, as agile delivery processes prefer to achieve a better quality in the same time. To agile delivery, we devote Section II of our paper. The already mentioned thesis delivery process description follows. Then we present problems in organization as paradoxes and problems in evaluation process in two consecutive chapters. We close the paper with a discussion and suggest several improvements, mostly in the form of strong recommendations.

II. AGILE DELIVERY

Many companies focus on fast incremental software delivery, and agile methods [1] are the new standard way to fulfill the increasing demands on incremental functional extension of software products [2].

Agile delivery is a decision framework to provide guides for disciplined end-to-end software delivery including documentation, tools, etc. S. Ambler developed it, and the most relevant source of information is the book [3] and the web domain disciplinedagiledelivery.com.

Shortly introducing, the methodology combines selected advantages of agile development methodologies, but as being more a guide, it is not defining anything as a must.

The key feature is that agile delivery can be adapted to any task and if the task grows or changes in any way, the delivery lifecycle is able to change with it. It is also flexible to qualities of participating people. Shortly, it is the ideal process for thesis implementation in the terms of both equality and equity.

For our purpose the key features are: people first, learning oriented, goal driven and agile.

How does it work? The ideal process starts with problem identification, which is usually done by the supervisor. Then, the goals are defined – again, the job for the supervisor. Goals drive then the development; each goal needs some new knowledge (learning). Student should consult the order of the goal selection with the supervisor according to his knowledge and experience (people first) that he (the student) sees all the time his own theoretical and practical progress. The order of the goals can be changed any time according to the situation and needs by the student or by the supervisor, which aims to fasten the production respectively achievement of stated goals and results. This last option is the agility property of the delivery lifecycle.

Agile delivery requires more patience from both student and teacher, more and better communication and good presentation skills. These presentation skills are required to improve communication when discussing further goals as well.

III. THE THESIS DELIVERY PROCESS

The thesis delivery process defines milestones the students need to reach. If any milestone was missed, the consequences are like lower final grade and notification. Checking of milestones is supported by a separate Moodle course.

In the three-semester long realization period for Masters' diploma thesis, the first semester includes 3 submissions. Each submission has to be unique and has to show the progress of student's knowledge in the field of the thesis topic and/or implementation. No other restrictions apply, which allows both theory and practical submissions.

The second semester defines also 3 milestones:

- A minimum of 10 pages of text for topics analysis has to be submitted including references to literature. The minimum amount of cited sources is defined as 15.

- For the second submission, the previously submitted document has to grow in number of pages up to minimum 20 pages, in number of citations up to 20 resources. The content structure requires besides the analytical part a motivation and definition of goals of the thesis too.

- Before the last submission in this set, students have to deal with conceptual design of their solution and methods description.

Again, a minimum size limit of the extended document is defined as 30 pages.

The last, shortened semester also includes three milestones with step-by-step increased value of the thesis document:

- The document should grow to minimum 40 pages and should include details on design and implementation of the proposed solutions aimed to achieve the thesis goals.

- The next milestone requires having evaluation and conclusions included. Conclusions should point out added value to the problem domain.

- The last submission should contain a final version of the thesis documents ready for reading by the supervisor.

As presented above, the first semester is not really considered at the milestones in the later two semesters.

At Bachelors' level, there are two semesters related to thesis implementation, also supported by Moodle LMS and also having 3 milestones per semester:

- Motivation and part of analysis should be submitted in size of minimum 8 pages plus list of minimum 10 cited references.

- For the second submission, analysis should be completed and goals should be added to the text of the thesis that it grows to a minimum of 12 pages. At least 5 new cited sources should be added too.

- At the third milestone, there should be the size of the thesis document above 18 pages. Concept of the solution and methods' description has to be added to the previous version of the work.

- Adding details on solution design and implementation has to grow the submitted document to minimum 24 pages.

- Additional six pages should be added to evaluate the solution and express added value to the problem domain.

- The last submission should contain a final version of the thesis documents ready for reading by the supervisor.

IV. THE PARADOX WE EXPERIENCED

First natural experience is that there is no implementation-related submission. More precisely, the milestones for implementation are missing or can

be found only by strong concentration as adding text on the implementation. But this is only once a semester or even less. The first paradox is that the Informatics study programme has no direct programming-related milestone defined in the thesis delivery process although the 99% of the tasks at the programme is programming-related!

Considering the delivery process structure including milestones and requirements, the student cannot make their choices whether they would like to start with implementation – no one presents him alternative scenarios so they will probably not search for any.

Although the most effective agile delivery process also requires some analysis at the beginning, but only the domain-driven approach requires finishing it before starting the implementation. The real paradox is: why are we forcing the students into domain-driven approach, which leads to a weaker solution in the horizon of just tens of weeks? Any other disciplined agile approach accepts to start the implementation after one subtask is clarified and is relying on the further inputs from the implementation and continuation of the analysis.

Considering the first semester of the Master thesis preparation, this is the only stage where the submissions can be chosen by the student (at least the content of them). This would allow the agile delivery, but then why are there the other two semesters? By our experience, there are groups of students that develop a solution in this first semester and during the following ones they are writing texts only to meet the criteria for the milestones. This could be also evaluated as a paradox, but also as a process where after a one-semester work there are two more semesters to write the documentation and polish the implementation results.

V. Thesis Evaluation and Drawbacks

Based on the suggested milestones, thesis evaluation could be based on these milestones. At least at the beginning, because as we already expressed, the implementation in the majority of the cases had a high impact on the overall outcome of the thesis – usually it was one of the main goals of the thesis.

For the Bachelor thesis, it is clear that the stepwise incremental development of the documents is the core to be evaluated; in addition to that the teacher finds the implemented software and its technical documentation. It looks easy to evaluate if everything was submitted on time. The first problem occurs with students who did not submit everything on time because of their laziness. These students will get a lower grade because of laziness. There could be

also someone who was ill for a longer time and could not add the required value but still managed to submit to the milestones. These students also get a lower grade because of quality. There could also happen that a combination of the above two situations occurs, namely that the ill student did not catch the milestone. This would also imply a lower grade. Now comes the drawback of the defined evaluation: if all milestones have to be passed on time, should we then reject all theses that were late due any reason? Or, we should apply equity saying the ill students get a second chance – a consolation path, while the lazy students will be rejected?

As actually the submissions during Bachelor thesis preparation are required by another subject (i.e. some tasks are shared), that subject solved the problem quickly: missing one deadline means no grade from the subject. This is just another implementation of our drawback, because the student will give up every activity related to his thesis if he knows he will be not allowed to submit it that year.

At Master level, the evaluation is also based on the submissions, which represents a systematic solution. This system is very tolerant to resubmissions of first-semester results into the specific milestones of the other semesters – teachers can do the checking against that but usually these later semesters are considered as documenting. Usually, because in the case of a theoretical thesis topic the documenting always starts much earlier (e.g. full analysis, first proposals and proofs).

There is also defined a disputable task with the theses that is positioned after the delivery. This task offers a possibility of preparing a scientific of technical paper proposal to the students, which paper proposal is then evaluated by the supervisor. This option presents a chance to improve the final grade. In fact, the most such proposals are of very low quality and are just a source of misunderstanding.

VI. Discussion and Suggestions on Improvement

We presented the thesis delivery process at our Department. Then, we pointed out the differences against agile delivery techniques and explained details on that. We also identified problematic parts of the related curricula such as sharing of tasks with zero tolerance and tolerance on copying previous results to later requested submissions.

These options should be eliminated. Sharing of critical requirements of two subjects itself just increases their importance, but the zero tolerance principle in one subject does not fit to the principle of grade limitation at the other subject.

There also should be introduced a mechanism that says that the first semester at Master level is devoted to agile implementation or, maybe a better option is to re-order the milestones in the way that the implementation becomes the second semester just after finishing analysis and making the proposals. As it is a subject for all students, and the milestones are defined for each of them equally regardless to their topic, it is a point to start discussions on possible changes. One change could be the above-presented reorganization to avoid copying of results.

For scientific paper preparation, it would be acceptable to limit it to the students working on research topics and not to force this option to the students implementing thesis topics from the industry.

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New approaches on learner autonomy and Learning English as an Additional Language

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Abstract - Learner autonomy in foreign language teaching and learning has been a favorite topic for a long time. Since the beginning of the millennium year, there have been lots of studies to promote learner autonomy in different levels of foreign language education at different schools and at different universities. In recent years, many new approaches and innovations have been used to develop learner autonomy in foreign language education. Helping foreign language learners to become autonomous is one of the fundamental and the universal duties of all of the foreign language educators . Learners who think that their learning styles and their efforts are necessary to develop the learning methods and approaches can be successful in learning new foreign languages. They can also give positive energy to their teachers or professors to develop their teaching methods and techniques. The concepts of `autonomy` and `responsibility` are two crucial requirements in learning and both of them require active practices. Responsibility and autonomy are not easy to distinguish. In this paper, their importance and their differences will be explained. The reasons of developing responsibility and autonomy will also be explained. New approaches on learner autonomy in foreign language learning and teaching will be highlighted. Language learning strategies will be handled. Sample classroom activities will be shared. Useful websites, blogs and books on learner autonomy will be suggested.

I. INTRODUCTION

Learner autonomy and learner responsibility are the fundamental topics in foreign language education. If the learners are not aware of their responsibilities, they can never be successful in learning new things. Learners who do not know their responsibilities in their class hours can easily demolish the enthusiasm and they can give negative energy to many learners who intend to learn new languages. Learner autonomy, learner responsibility and motivation are always related with each other as no one can learn new things if they are not enough motivated. To increase the learner responsibilities and to help the autonomous learners, teachers should know some essential classroom applications. It is hoped that this study will help foreign language educators to prepare different kinds activities in their classes.

II. THEORETICAL BACKGROUND

A. What is learner autonomy?

In [9] is states that; "The Sheffield Hallam definition of learner autonomy starts with the premise that an autonomous learner takes responsibility for his/her own learning. In doing this they can identify:

- their learning goals (what they need to learn)

- their learning processes (how they will learn it)

- how they will evaluate and use their learning

- they have well-founded conceptions of learning

- they have a range of learning approaches and skills

- they can organize their learning

- they have good information processing skills

- they are well motivated to learn

In [8] is illustrated this: "It is noteworthy that autonomy can be thought of in terms of a departure from education as a social process, as well as in terms of redistribution of power attending the construction of knowledge and the roles of the participants in the learning process."

It has also been mentioned in [9]: "Learner autonomy is a problematic term because it is widely confused with self-instruction. It is also a slippery concept because it is notoriously difficult to define precisely. The rapidly expanding literature has debated, for example, whether learner autonomy should be thought of as capacity or behavior; whether it is characterized by learner responsibility or learner control; whether it is a psychological phenomenon with political implications or a political right with psychological implications; and whether the development of learner autonomy depends on a complementary teacher autonomy (for a comprehensive survey, see Benson 2001)."

B. What makes an autonomous learner?

Good lesson plans, modern teaching techniques and approaches help language learners to be autonomous learners.

In [10] is indicated: "In theory, we may define autonomy as the freedom and ability to manage one`s own affairs, which entails the right to make decisions as well. Responsibility may also be understood as being in charge of something, but with the implication that one has to deal with the consequences of one`s own actions. Autonomy and responsibility both require active involvement, and they are apparently very much interrelated."

If learners feel themselves happy and active in their class hours, they can be autonomous learners. Using the same teaching method or the same approach can make the learners bored and unhappy in their class hours. Different kinds of methods and approaches will be useful to make them autonomous learners.

C. Why should we develop responsibility and autonomy?

In [10] is stated that: "The saying goes: you can bring the horse to water, but you cannot make him drink. In language teaching, teachers can provide all the necessary circumstances and input, but learning can only happen if learners are willing to contribute. Their passive presence will not suffice, just as the horse would remain thirsty if he stood still by the river waiting patiently for his thirst to go away. And, in orser for learners to be actively involved in the learning process, they first need to realize and accept that success in learning depends as much on the student as on the teacher. That is, they share responsibility for the outcome. In other words, success in learning very much depends on learners having a responsible attitude.".

Responsibility and autonomy should be developed for the following reasons:

- To have better class hours

- To create joyful class hours

- To have more successful and happy students

- To have more students who have self confidence and respect

- To create creativity and giftedness.

D. What are learning strategies and why are they important?

As [4] indicate:

"There are two major reasons why we integrate learning strategies into the instruction of academic language and content. The first is the theoretical consistency of learning strategies with the cognitive view of learning which underlies CALLA (Cognitive Academic Language Learning Approach). The second is the impressive amount of research that supports using learning Strategies with academic language and content information."

Chamot and O`Malley (1994, pp. 59-60) further illustrate this: " Based on the theory and research related to learning strategies, there are four basic propositions that underlie the use of learning strategies in CALLA.

- Active learners are better learners.

- Strategies can be learned.

- Academic language learning is more effective with learning strategies.

- Learning strategies transfer to new tasks.

It has also been mentioned in [4]: Learning strategies are defined as thoughts or activities that assist in enhancing learning outcomes. Strategies by definition are probably performed with awareness or else they would not be strategic, although the same mental operations can be performed without awareness once they are proceduralized and have the same beneficial results with learning. Three broad categories of learning strategies have been proposed in the cognitive literature and our own research. These types of learning strategies are based in part on theory and in part on the observation that students report using what seem to be executive skills with learning tasks while also using strategies that apply directly to the learning activities. The three types of strategies are as follows:

- Metacognitive Strategies- Planning for learning, monitoring one`s own comprehension and production, and evaluating how well one has achieved a learning objective;

- Cognitive Strategies- Manipulating the material to be learned mentally (as in making images or elaborating) or physically (as in grouping items to be learned or taking notes); and

- Social/Affective Strategies- Either interacting with another person in order to assist learning, as in Cooperative learning and asking questions for clarification, or using affective control to assist learning tasks.

E. What is motivation?

As it has been mentionedin [7]: "Language teachers frequently use the term "motivation" when they describe successful or unsuccessful learners. This reflects our intuitive belief that during the lengthy and often tedious process of mastering a foreign/second language (L2), the learner's enthusiasm, commitment and persistence are key determinants of success or failure. Indeed, in the vast majority of cases learners with sufficient motivation can achieve a working knowledge of an L2, regardless of their language aptitude, whereas without sufficient motivation even the brightest learners are unlikely to persist long enough to attain any really useful language."

F. Motivation and vision in language teachers' development

Motivation is essential for language teachers' development, because they can achieve to do lots of useful activities in their classes and they can often follow the latest innovations on their professions, if they are motivated well or if they know how to motivate themselves. A fresh perspective is always crucial in motivational teaching. Lesson plans have to be prepared according to the age groups, language proficiency, socioeconomic backgrounds and according to the previous language learning history. When teachers enter the classroom, they are aware how languages should or should not be taught and how languages should be learnt effectively. Two teachers can apply the same methods and techniques for the same courses in different classes. Students in one teacher's class can be more active, talkative and cheerful during the class hours and students in the other teacher's class can be quite and stressful. They can also get bored. This is because of the differences in the teachers' mindsets. The teachers' vision of themselves in the future is a very important issue for their students, because how students engage with new ideas and how they are grown as professionals depend on their attitudes and their teaching methods. [6: 22- 24].

G. What are the new approaches in language learning?

- The wonder approach

L'Ecuyer (2014) states that: "Wonder, innate in the child, is an inner desire to learn that awaits reality in order to be awakened. Wonder is at the origin of reality-based consciousness, thus of learning. The scope of wonder, which occurs at a metaphysical level, is greater than that of curiosity. Unfortunate misinterpretations of neuroscience have led to false brain-based ideas in the field of education, all of these based on the scientifically wrong assumption that children's learning depends on an enriched environment. These beliefs have re-enforced the Behaviorist Approach to education and to parenting and have contributed to deadening our children's sense of wonder. We suggest wonder as the center of all motivation and action in the child. Wonder is what makes life genuinely personal. Beauty is what triggers wonder. Wonder attunes to beauty through sensitivity and is unfolded by secure attachment. When wonder, beauty, sensitivity and secure attachment are present, learning is meaningful. On the contrary, when there is no volitional dimension involved (no wonder), no end or meaning (no beauty) and no trusting predisposition (secure attachment), the rigid and limiting mechanical process of so-calledlearning through mere repetition become a deadening and alienating routine. This could be described as training, not as learning, because it does not contemplate the human being as a whole.Gifted and talented students can start to enjoy listening to their courses and attending their courses with the help of the wonder approach. Because they can feel the importance the meanings of learning.

- Happy learning approach

As it has been mentioned by Veenhoven (2014:4): "The word 'happiness' is used in various ways. In the widest sense it is an umbrella term for all that is good. In this meaning it is often used interchangeably with terms like 'wellbeing' or 'quality of life'.

Seligman (2002:102) states that: "Happiness in the present moment consists of very different states from happiness about the past and about the future, and itself embraces two very distinct kinds of things: pleasures and gratifications.

When students realise the pleasures and the gratifications of their own lives, they can start to study their courses heartily and happily. With the help of the warm-up activities and the group work studies, students can feel their own pleasures.

- Learning languages with the ICT

As it is stated by UNESCO (2009-2014): "Information and Communication Technology (ICT) can contribute to universal access to education, equity in education, the delivery of quality learning and teaching, teachers' professional development and more efficient education management, governance and administration".

III. METHOD

A. Participants

The participants consisted of 90 university students at South East European University in Tetovo in Macedonia. Their ages ranged between 19 and 22.

B. Teaching procedure

The participants were asked to reply to the following questions during the 1st and the 2nd weeks of their courses:

- Do you like listening to music while studying English?

- Do you like drawing pictures?

- Do you like taking photos?

- Do you like acting and dancing?

- Do you like using the internet?

- Do you like using your mobile phone for learning English?

- Do you like cooking?

- Do you like travelling?

- Are you an optimist or a pessimist person? Why?

- Do you live alone or with your family?

According to the answers of the questions I asked, different classroom activities and methods were used to motivate my students in my class hours.

C. Sample Classroom Activities 1

- Using Quotes - This warm up activity was a 5 minute activity. Students were asked to bring quotes which could give positive energy to their partners in their classes.

- Using the pictures and the photos from the internet - This activity was used to teach some gestures and the pronunciations of some words

- Using music and some songs in the classroom - According to my students' music tastes, I used some songs while they were writing their compositions or paragraphs in the class hours.

- Using Word Charts - Students described their words and drew the pictures of the words they were given.

- Using Photos - Students brought the photos they had taken and showed them to their partners or to their classmates and talked about them.

Students were asked to use the internet and they were asked to bring pictures and photos on different kinds of hobbies to their speaking classes. They were asked to do pair work and group work activities with the following quotes by using their pictures and their photos: They were also asked to bring pictures and photos to their speaking classes. They used their pictures and photos while talking about the following titles and quotes.

- Be a Pessimist or Be Hopeful and Optimistic (Ben-Shahar, 2012, p. 91) y You see things; and you say, "Why?" But I dream things that never were; and I say, "Why not?"- George Bernard Shaw

- Insist on Perfection or Recognize when good enough will do (Ben-Shahar, 2012, p. 156)

- Settle for a choice that meets your core requirements rather than searching for the elusive best.- Barry Schwartz

- Surrender to Negativity or Bring positive energy wherever you go (Ben-Shahar, 2012, p. 174)

- Wherever you go, no matter what the weather, always bring your own sunshine. - Anthony D' Angelo

- Dwell on Failures or Focus on Successes (Ben-Shahar, 2012, p. 265) y

- Wherever your attention goes, your energy flows and life grows.- Brian Bacon

- Never too old: (Tishio, 2012, p. 15).

- You are never too old to set another goal or to dream a new dream.-C.S. Lewis

D. Objectives

- To give students the chance to practice English as much as possible.

- To teach students new words on optimism and positivity

- To teach students new words on gestures which could be useful in the global world

- To teach students how to communicate effectively

- To teach them pronunciations of the new words effectively

- To teach students how to use the internet and their mobile phones effectively for their languagelearning studies.

IV. FINDINGS

A. Students' Attitudes

All the students in my classes were very active and bright students. Theywere interested in learning English as a second language and they liked learning English with different kinds of classroom activities which motivated them effectively. They also liked using the internet and the google for their studies. Students in my classes were not attending my classes regularly in the first and the second week of my courses. Their attitudes completely changed after the third week of their courses. They became more positive thinkers and learners. They had a desired future self-image (vision) and created their own visions to learn English as a second language more effectively after participating the classroom activities which motivated them during the class hours.

B. Students' Perceptions

All the students found the teaching tasks very useful and they realized that they improved their language skills effectively. They brought their quotes, pictures and photos regularly to do their warm up and pair work activities. Their fluency and accuracy improved day by day rapidly while doing their pair work activities with their pictures, photos and quotes. During the first and the second week of my courses, students in my classes were attending my classes halfheartedly. They were not interested in learning English as a foreign language. Classroom activities which were used in my classes helped them to motivate themselves and their communication skills improved day by day. They became enthusiastic and active students who were interested in learning new things. They started to ask me and the other instructors to give them more topics to talk about during the class hours and they also wanted to study the grammar tests full-heartedly.

V. CONCLUSION

Motivation and learner autonomy are the essential issue in human's life. People can achieve lots of things and struggle against lots of problems, if they can be motivated well or if they can know how to motivate themselves. Motivation is a very important subject for our students. Students can be more active and talkative, if they can be motivated with the new and modern approaches effectively. Up to here, the definitions of the words of `learner autonomy` and 'motivation' have been given. The role of motivation and vision in language teachers' development has been told. Motivating language learners through vision has been explained. How the classroom activities can be used with the new approaches and methods effectively has been explained. Sample classroom activities have been suggested. I hope this study will help my colleagues to do more joyful and happier classes. It is also hoped that students will be more creative and optimist after being motivated by the teachers or professors of their classes.

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Veda Based Psychological and Pedagogical Support of College Graduate Students

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Abstract - We propose an analytical approach to synthesis of teacher-student interactions on the stage of graduation on the base of Vedic concepts related to human psychology. Some aspects of the interaction are considered and recommendations are proposed. Result of application of the recommendations will reduce students' stress and, hence, improve creativity.

I. INTRODUCTION

The main problem of a college graduate student supervisor is a support of a productive creative environment, allowing the formation of students' sense of subjective well-being. This is possible if a stress usually resulting due to a number of reasons is reduced. The reasons are as the follows: uncertainty, ambiguity and complexity of the graduate problem formulation; restrictions of the necessary information access; conciseness of time for the graduation work by student's opinion; student's qualm; etc.

A stress also may arise in student-teacher interaction due to teacher's lack of psychological knowledge. The lack results in the obvious and most frequent behavioral model – teacher's personal mentality. In Vedic psychology the model, i.e. a transposition of the properties of personal mentality to other people, is denoted as *impersonality*. The intuitive approach is adequate in prediction of a behavior of the people of the same gender, but completely inadequate for opposite gender.

Our exploratory interest to Vedic psychology, which describes man, woman and child mentality in details, push on the idea of its application to psychological and pedagogical support of graduate students. The basis of Vedic psychology [1] consists of a system of strict concepts and relationships between them. The concepts and relationships are specified by laconic and constructive definitions, which are analogous to basis definitions of Georg Hegel's philosophy [2]. Interpreting [3] students' behavior and their relationships with other people in

Vedic concepts, we synthesized recommendations of adequate behavior of supervisor. The adequacy means the *responsibility* of the supervisor to construct higher level of creativity in students' environment.

II. VEDIC PSYCHOLOGY CONCEPT BASIS

Let us consider the basic concepts and relations of Vedic psychology. The basic entity of existence is *soul*, which is *immortal* and *indestructible*. The soul *evolves* in a human or animal *incarnation*. The evolution means *fulfillments of desires*, which approximate the soul to state of happiness, ideally nirvana. *Happiness* is the soul (human) ability to act according to his/her nature (its complex of fundamental desires). In other words, a human being is happy if he or she realizes the personal life meaning and does not suffer from great deprivations and afflicts. The whole spectrum of recognized and not recognized desires within a human being of the infinite soul forms a complex of *karma* and *dharma*.

Human mentality is qualitatively divided on *man* and *woman*, with both equally tend to happiness, but the conditions of an achievement have almost nothing in common. For example, men when born have "primitive" level spiritual order, and they *must be infinitely improving* selves in this direction starting from teenage years. Men's self-concept is rising according to his achievements. Women have at birth a *divine spiritual order* that she and her environment must strive to retain for life.

In addition to above mentioned basic properties, an ideal women's mentality have the following remarkable features: she have *natural aspiration to patronize* (to take care) of dependent people and *comply* with her patron ("energy-distributive system"); *attaches* to her environment, as a regularity forms a feeling of security. An ideal man's mentality is originally *egocentric*, and this is expressed as self patronage and self-care

("energy-conserving system"). Men have enhanced natural adaptation to environment that allows carrying on an active search for new opportunities [1].

Another important conception of Vedic psychology is "principal-subordinate" human relation. A good principal must be *confident in what he is doing*: clearly imagine goal; be able to proceed to the goal regardless circumstances and current productivity (*self-renunciation*); be *ascetic*, i.e., consume minimum resources of subordinate system; be aware of mental nature and needs of subordinates.

III. TEACHER-STUDENT SYSTEM OF INTERACTION

Teacher-student interaction is generally isomorphic to "principal-subordinate" relation. Teacher patronizes students, giving knowledge, directs the process of skills acquisition, i.e., trains students to solve problems, which will be stated in the future. Students devote sometime of teacher's life and to the field of teacher's interest. Playing principal role, in order to increase students productivity, teacher should possess all four qualities: he should have strict action plan, he must be self-renunciative, ascetic and aware of students' mentality nature (life meaning). In this case, teacher's authority will be, at least, retained, and in the case of successful leadership, the authority will rise. This is a necessary factor of stress reduction and formation of students' sense of subjective well-being.

Self-renunciation of a teacher is primarily patience and equally fair attitude towards students. At the graduate stage this quality is shown especially acute: sometimes students due to stress are not ready to apply the consumed knowledge to their problem subject. Asceticism is expressed not only as humility of teacher, but primarily in understanding that the students' results have academic nature and aimed at knowledge and skill acquisition. It is almost impossible to profit from the student's invention. Teacher also must supply a maximal level of information and organizational provision for students. The fourth quality requires teacher to provide graduate problems for students according to their mental nature, to create a personal a way of collaboration (consultations, encouraging, direction, etc.).

Consider a Vedic point of view on the ways of students' creative activity depending on their genders. The creative process (e.g., problem solving) of male students is independent and occurs in isolation ("in a personal cave"). Teacher must precisely define the problem and informational sources, and then allow him to switch in the individual mode. Female students solve problems mainly during communication with other students and teachers. Experience shows that isolation is not comfortable and productive. Supervisor should periodically and sufficiently frequent inquire them of the obtained results and current unresolved problems. A male student can easily define properties of a solution to be found at the first stages of problem solving. They easily recognize that the solution has been already reached. Female students frequently reach the solution on a sudden, and even could pass it. A collectives consisting of students of both genders have a greater productivity, as young men play basic role in progress towards the solution, and ladies provide communication and information beyond the general line of the project development. This is also confirmed in [4]. At the time of achieving the goal women mentality is also useful since they naturally will propose further improvement of the obtained result.

IV. ESTIMATION OF STUDENT'S RESULTS

One of outstanding and problematic property of female mentality is association of creative result estimations with self-identity. A negative scoring (estimation) her work audibly is immediately transferred to the self-identity. It would better if supervisors spare from the negative estimations at all, as college education is a relatively small part of women's life, but it can form inhibitory self-identity for the rest of life. Teacher could emphasize good aspects of the result or focus on the features, which aren't transferred to mentality. During all period of graduation teacher must be sure, that ladies do not fill alone and understand, that the responsibility for the outcome is shared between her and her teacher. If she fills herself completely out of responsibility, the productivity rises drastically.

Characteristics of female students should be based on assessment of the results obtained, as characterizing personality does not affect self-identity significantly. The possible directions of further personal professional advancement should be precisely formulated. This and mentor's authority will influence female student self-concept.

V. CONCLUSION

In this paper we interpreted a part of the conceptual level (ontology) of Vedic psychology in terms of teacher-student psychological and pedagogical interaction on the stage of producing results of graduation. Practical recommendations to

advance skills of teachers aimed at understanding mental personal meaning and forming a sense of subjective well-being of students has been deduced. Application of the skills during graduation should improve productivity of students' creativity. The recommendation is being tested in graduate student collectives of Irkutsk universities.

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Computing Innovations in a Modern School

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Abstract -The pedagogical conception of school and teaching of J. Komenski appeared in the time of increased productive, educational and spiritual needs at the time of antischolastic period and famous thinkers-philosophers. Komenski made a big transformation in teaching. He made a Copernican twist in education. It is thought that this was an epic innovation. However, what was progressive could not last forever, like many other innovations. The traditional school and teaching nowadays represent "the bottleneck" of better quality work. In the computing society where changes happen fast what is sought is a new, more efficient, innovative school of constant development changes. Traditional, insufficiently effective conception of teaching is improved with a more efficient one, based on a new computing paradigm.

The paper discusses the application of informatics innovation in function efficiently modeling school. The paper discusses how the use of modern information technology is changing the essence of the teaching process itself..

I. INTRODUCTION

What was once considered progressive and good does not necessarily remain so forever. This also applies to the pedagogical conception of Jan Amos Komensky (which appeared in the time of significantly increased productive, educational and spiritual needs during the period of antischolastic atmosphere made under the influence of Bacon, Decartes, Spinoza and Leibnitz's philosophy) and was a revolutionary step compared with the previous situation. In the new spiritual atmosphere the pressures of the religious dogma were fading, so there appeared new tendencies in education as well, within which The Big Didactics by Komensky appeared as a Copernican twist in schools and education. Its developmental contribution is well known: the democratization of education (education became more available to common people); teaching plan and program; division of teaching contents into different subjects; the lesson-teaching system; a more rational organization (one teacher works with a large number of students); a school year. However, that paradigm, later developed by Herbart and which proved to be effective and suitable in the long term, has gradually worn off both technically and didactically. The scheme which implied clarity, association, system and method has lasted, lasted and become outlasted in the end. Teaching with a teacher in the centre and students on the outskirts, with a frontal way of work, based on didactical materialism, book-centred and distanced from real life, dogmatically articulated, requires a lot of memorizing and little thinking.

The top weakness of traditional pedagogy and school is that it is focused on teaching, it neglects studying and that teaching is not based on systematic grounds.

II. NEW REALITY AND SCHOOL

Traditionalism in teaching is completely incongruous with social, technological, scientific and cultural circumstances by the end of XX and beginning of XI centuries. School environment has obtained new qualities, it has become wider and richer thanks to a strong development of the modern computing technology, new aspects of didactic theory, globalization of the education environment, world trends through national educational systems, and a very fast inflow of new information. A student is in a significantly different cognitive position in comparison with half a century ago. Owing to computer technology, visual media, mass media, etc., students have the possibility to use more than one source of knowledge, and earlier they could rely only on books and teachers. Student's home and the surrounding environment have become a strong competition to the school classroom. Pedagogy of studying and interactive didactics makes a strong pressure on the educational process itself. Good quality teaching is not measured by the teacher's interesting approach to teaching, but by students' thinking and working activity. The focus of teaching is on studying, and much less on teaching. Formative function of the teacher is increased rather than informative one, which means that greater attention is paid to the development of the personality rather than learning the teaching material. In accordance with the efforts to make teaching more focused on

learning rather than teaching, the aim of the teacher's work is transferred onto the organization and control of the teaching process, where motivational and educational tasks become more significant.

Simply speaking, the teacher is required not only to point to a logical connection among scientific facts but also to manage the teaching process, to make sure that every student in this process is mentally and physically active, to cooperate with students and to make them evaluate their own work.

For the school of the future, as per the opinion of M. Vilotijevic (2009), the following characteristics will be valid (given in concise form):

- Students achieve success in accordance with their natural potentials and endeavor. All normally developed students can achieve a satisfactory success if suitable teaching methods are applied.

- In a school of good quality, activities are various and involve not only studying but also satisfaction of many students' needs and interests – intellectual, cultural, sportive, social, etc.

- Teaching is systematically organized, which means that the teaching process should be rounded and to include the creation of a working environment, realization of the planned tasks and the control of the performed. The feedback information follows the whole teaching process so that students and teachers always know if they have or have not fulfilled their tasks.

- 4.In primary school one teacher organizes and manages teaching of several subjects because that personal concentration enables the teacher to focus more on the student, not only on the subject itself, and to perform other functions – educational, advisory, diagnostic, evaluative.

- Teaching is didactically and methodically diverse and it is not dominated by frontal work, but what is practiced is cooperative forms of work, work in groups and tandems, as well as individual work with students.

- The focus of the work is on thinking activities, on problematic approaches and practical application of the acquired knowledge.

- The evaluation of work and results is continuous and is based on a permanent feedback principle.

- In a modern school everyone studies, not only students and teachers. Vocational improvement, tracking of the development of the particular vocation and didactic-methodical innovations, is a permanent obligation of every teacher.

III. COMPUTING INNOVATIONS AND STUDYING

The basic problem of education not only in our country but in many others as well is how to get from a traditional school with all its characteristics and weaknesses to a modern one where all the students will be satisfied and successful. The present state is familiar. There have been words about it. It is necessary, as per the modern theoretical conceptions to: a) make the educational process based on teaching be transformed into the process of studying, which means that a student has to be the subject of that process; b) make the teacher relate to the student as an autonomous person; c) base teaching on a rich interaction as a social relationship; d) pay greater attention to not only the acquisition of knowledge but also to the moral and evaluating formation of a student; e) make the teaching work not a simple transfer of knowledge but enable the organization of a working and mental activity of the student. Modern school should suit modern and future needs, and modern age is characteristic of innovations in all areas of work, which imposes an obligation to the school to be innovative itself.

Innovative process begins from a new idea, from the knowledge which is the result of scientific research. The second phase of the innovative process is the introduction of innovations into practical usage, and the third one is the diffusion of innovations. The purpose of the educational innovation is to help the teaching become better, more open, elastic, individualized, creative, and continuous. A strong impulse to the improvement of education can be given by modern technologies of studying: computing approach, Internet technology, computer programs, usage of electronic networks. The switch from traditional to modern computing technology is very complex and requiring. D. Mandic (2010) says that this switch implies changes in methodology, forms and organization of the teaching process. J. Djordjevic (2003) points out that by applying the computer as a teaching tool the teacher can manage the teaching process in a usual way with the difference that now it is not a dialogue with the class but a "trialogue" between the teacher, the student and the computer. This form of communication is supported by and adequate program and it significantly widens the teacher and students' possibilities in processing and acquisition

of knowledge. By using modern computing technologies the essence of the teaching process is changed, as well as pedagogical approaches. N. Potkonjak (2003) says that new technology leads to changes in all classic teaching methods and all teaching forms, because now there are new possibilities and sources of learning, new ways of acquiring knowledge.

The advantages of applying modern computing media in teaching are great. These media are superior in relation to traditional didactic media, and this superiority, as per D. Mandic (2010) is reflected in the following aspects:

- Both the teacher and the student are relieved of various routine activities, so students acquire knowledge faster and more easily, they develop their skills more gradually, they develop their personalities more integrally and achieve emancipation;

- The teacher adapts the teaching process more successfully to the student's previous knowledge, interests, cognitive learning styles, abilities and work rhythm;

- Students are more motivated, more careful and they participate more actively in all the phases of the teaching process – preparation, organization, realization and verification;

- More modern methods and approaches are introduced, some of them are demonstration of laboratory activities, research and discoveries, work on projects, simulations, model learning, etc.;

- Basic teaching principles are realized more consistently – individualization of the teaching process, suitable programs for the age characteristics, conscious activity, obviousness, systematic work, correlation between the teaching process and practice;

- Students are encouraged to check and broaden their knowledge outside the classroom.

Possibilities for the improvement of the teaching process offered by computing technologies are great. Various authors have written about them. Computing technology enables a completer twist in the way of working and living, that is why it causes a strong shock, especially with the traditionalists. It resembles a little this ludicrous movement from the beginning of XIX century, when workers destroyed machines thinking that they were responsible for their hard state of life. Similarly, computing technology hardens the lives of those who do not understand it or accept it very suspiciously. Virilio, as per the quotes of M. Andevska (2003), says: "What does the cyber space bring, or computer virtual reality? A pile of confused disturbances (visual, social, psycho-motoric, affective, intellectual), which make children and adults not posterity, heirs and cousins to the genes but to a gruesome technological contamination. Due to the loss of "freedom of behavior", all critiques of technology have disappeared and we have unconsciously slipped from pure technology into dogmatism of the totalized techno-culture. We have fallen into a trap of what has progress made of us, we have become deprived of the usage of our natural receptive organs, our sensuality, trapped into a web above all webs, webbed by a virtual reality of the Internet."

If we were to follow Virilio's conception, we would have to give up a lot of benefits brought by the civilization development because we are "deprived of the usage of our natural receptive organs". We think that the ones who point out that the usage of modern technology leads to the isolation of an individual are wrong, because that technology connects the man with the whole world, science, libraries, modern events, etc. A student from a students' classroom or his study room experiences a volcanic eruption, icy landscapes of the Arctic and the Antarctica, rainforest's flora and fauna.

The authors who point out big interaction possibilities of modern computing technologies are right (modern theories of earning insist on them). D. Mandic points out that computer supported studying is very suitable for the realization of the student-computer interaction, which helps improve technology of study, the teaching process is made more obvious, dynamic and interesting ,because it engages more of the student's senses. He says that such a kind of studying involves multimedia education software, computer simulations, virtual reality, artificial intelligence, etc. The weak aspect of traditional teaching is irregular feedback, which disables timely elimination of weaknesses of the teaching process. On the other hand, computing technology provides the situation in which feedback follows every phase of the educational process and work. This ensures a continuous control of the teaching activity and regular evaluation of students' and teachers' results. Mandic points out that this technology can be used for studying at the same time and same place, different time and different place, and that it by far surpasses all other forms of classic teaching and distance teaching.

By its various possibilities, computing innovative technology imposes itself as a fantastic means for modeling of not only quality and efficient teaching process but also all the activities of a modern school, which faces very responsible and challenging tasks.

This technology permeates the contents of education, teacher's activity, teaching forms and methods, learning styles, evaluation processes, complete work of a school, etc.

IV. CONCLUSION

Traditional organization of teaching was an epic innovation. However, everything is related to its time. What was once extremely progressive today is obsolete. Traditional school is turned to the past, and a modern school has to be turned to the future. In a fast-changing society, school has to be adaptable to changes. School as a creator and disseminator of knowledge has to be the leader in changes. Knowledge generates changes. Insufficiently beneficial traditional organization of teaching gives more and more way to the teaching based on computing paradigm. New computing technology is more and more miniature and more powerful and contributes to efficient teaching and learning. Computing-didactic innovations are the main force in an efficient school.

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Parent's Attitudes About Traditional or Modern Teaching

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Abstract - Problem of the research is conflicting attitudes of parents as to what type of tuition is better and more efficient for presentation, teaching and learning and teaching content by their children. Contradictory opinions of parents are from several different criteria.

I. INTRODUCTION

One of the criteria, in this research, is the age of the parents. Young parents who are more informed about the existence and efficacy of modern teaching and modern technology are certainly inseparable elements of modern teaching because they are more for modern way of teaching realization. While older parents who are not so familiar because of their age, a job that doesn't have so much contact with the modern technology, the way of their learning and who don't understand the benefits of modern learning are more traditional teaching methods.

Contradictory opinions exist according to qualifications and field of work of the parents. Highly educated parents who have had contact with modern technology through their studies through the work they do and who are a little more deeply penetrated into the core and essence of the modern teaching are certainly it's more contemporary form of learning, as opposed to low-skilled parents, who haven't had the opportunity to encounter, and perhaps even using modern technology and even more knowledgeable and informed on what it is based and which are the purposes of modern learning, which are certainly the opponents of this type of teaching.

The research problem is that some parents were supporters of old school, they think that mediation between student and teacher content is good because the students indicate the essential facts, teach them the essential facts that are essential for further work, don't allow children to make the wrong conclusions about teaching content and completely wrong adopt them, provide economical teaching time, which isn't "waste time" to seek the right path children to essential and accurate facts can immediately get from the teacher that finished giving facts essentially facilitates understanding…

From the other side some parents, who are supporters of modern school, consider that the use of modern technology is extremely facilitates and accelerates the learning and progress of children contrary to the outdated method of writing on the blackboard which takes lot of time (instead, there are presentation via a projector made available students) to use modern teaching influences the activity of students who own intellectual and practical tinder coming to some facts which are therefore understandable and fully understood by the students and long remembered and even if there are mistakes that professor tells them, they learn from own mistakes and maybe better to remember. For all these and many other reasons, there is a strong backbone between traditional and modern schools or learning.

A. Research subject

Research subject is coming to empirical data on attitudes and opinions of parents on traditional teaching and modern teaching or the information about that are they more supporters of traditional or modern teaching.

B. Purpose and character of researching

The purpose of the research is to determine the attitude of parents on what kind of classes they think better and more quality for children to acquire knowledge, whether traditional or modern teaching classes in their opinion gives better results.

Tasks of research:

- Examine the parents about traditional teaching or modern teaching (Better quality of teaching in adopting knowledge by their children).

- To determine the significance of differences in the views of parents on traditional teaching or modern teaching according to the gender of parents (Better quality of teaching in adopting knowledge by their children).

- Determine according to age parents significance of differences in the views of parents on traditional teaching or modern teaching (Better quality of teaching in adopting knowledge by their children).

- Determine the professional qualifications to parents significance of differences in opinions of parents on traditional teaching or modern teaching (Better quality of teaching in adopting knowledge by their children).

- According to the parents to identify the basic reasons for the better applicability of traditional teaching methods or modern teaching methods.

- Identify the advantages and disadvantages of each time determinants.

C. Research hypotheses

On the basis of the purpose and character sets the following general hypothesis:

- Parents are more of modern (interactive) form of education because they believe it gives better results of learning and memory of the old (traditional) forms of teaching.

On the basis of the purpose and character sets the following specific hypothesis:

- Between the parents there is no statistically significant difference in attitude about the type of teaching that gives the best results in this case of modern teaching, considering gender parents.

- Between the parents there are significant differences in attitude about the type of teaching that gives the best results in this case of modern teaching considering the age.

- Between the parents there is no statistically significant difference in attitude about the type of teaching that gives the best results in this case of modern teaching considering professional qualifications.

D. Research methods

During the research, using descriptive methods.

Within descriptive methods in gathering empirical facts we have used questionnaires, scales and tables.

E. Techniques and instruments of researching

As part of the research interviewing was used as a research technique and as part of interviewing questionnaire was used as research instrument that

determines parents' attitudes towards traditional or modern teaching.

II.   RESULTS OF RESEARCHES

TABLE I.   ATTITUDES OF PARENTS ABOUT TRADITIONAL OR MODERN LEARNING CONSIDERING GENDER PARENTS

Gender	Attitudes of parents about traditional or modern learning		Total
	Traditional learning	**Modern learning**	
Male	5	35	**40**
Female	17	35	**52**
Total:	**22**	**70**	**92**
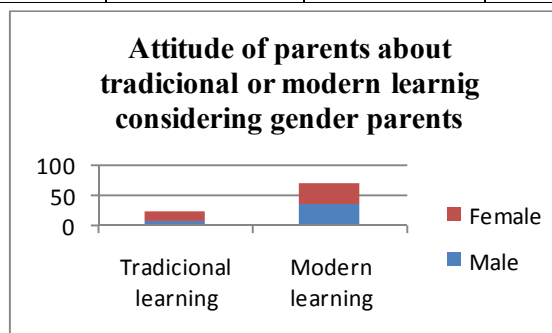
Figure 1.   Graphical display of data in Table 4

TABLE II.   ATTITUDES OF PARENTS ABOUT TRADITIONAL OR MODERN LEARNING CONSIDERING PROFESSIONAL QUALIFICATIONS

Professional qualification of parents	Attitudes of parents about traditional or modern learning considering professional qualifications		Total
	Traditional learning	**Modern learning**	
Primary school	2	3	**5**
Secondary school	15	45	**60**
High school	4	10	**14**
University	1	12	**13**
Total:	**22**	**70**	**92**
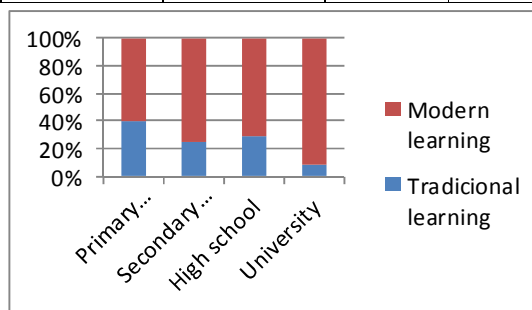
Figure 2.   Graphical display of data in Table 5

TABLE III.   ATTITUDES OF PARENTS ABOUT TRADITIONAL OR
MODERN LEARNING CONSIDERING THE AGE

Parents age	Attitudes of parents about traditional or modern learning considering the age		Total
	Traditional learning	Modern learning	
26-30	2	2	**4**
31-35	6	15	**21**
36-40	7	20	**27**
41-45	5	20	**25**
46-50	2	9	**11**
51-55	0	3	**3**
56-60	0	1	**1**
Total:	**22**	**70**	**92**
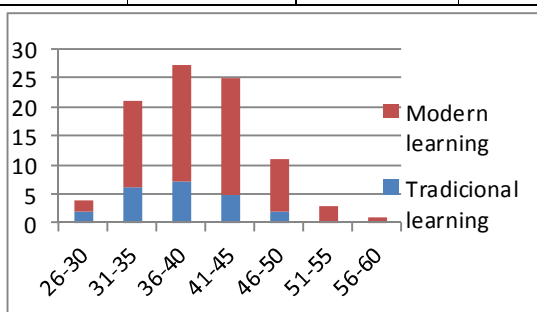
Figure 3.   Graphical display of data in Table 6

III.   CONCLUSION

1. Sub-hypotheses – It's believed that between the parents there isn't statistically significant difference in attitudes about the type of teaching that gives best results, in this case modern teaching considering gender of parents – studies confirmed this hypothesis for the reason that 35% of men supporters the modern teaching of all respondents and 35% of women of all respondents as a fully equal.

2. Sub-hypotheses – Between parents there are significant differences in attitudes about the type of teaching that gives the best results, in this case modern teaching, considering the age – according to the processed data we see that 50% of parents with age from 26 to 30 are for modern type of learning than the total number of all respondents of those years, 71.4% of parents with age from 31 to 35 are for modern type of learning of all parents in those years, 74% of parents with age from 36 to 40 are for modern type of learning of all parents in those years, 80% of parents with age from 41 to 45 are for modern type of learning of all parents in those years, 81.8% of parents with age from 46 to 50 re for modern type of learning of all parents in those years, 100% of parents with age from 51 to 55 are for modern type of learning of all parents in those years and 100% of parents with years from 56 to 60 are for modern type of learning of all parents in those years.

The foregoing results show that there are significant differences consider the age because the parents who were interviewed between 51 and 60 years aren't for traditional form of learning at all.

3. Sub-hypotheses – Between parents there isn't statistically significant difference in attitudes about modern / traditional learning considering professional qualifications. By the results of the research we have confirmed this hypothesis because 60% of parents with primary school more for modern learning of all parents with the same qualifications, 75% of parents with secondary school more for modern learning of all parents with the same qualifications, 71.4% of parents with higher education more for modern learning of all parents with the same qualifications and 92.3% of parents with university more for modern learning of all parents with the same qualifications. This indicating that there aren't significant differences between parents considering professional qualifications.

The main hypothesis – The results showed that the attitudes of parents of modern learning compared to traditional learning higher, namely 76% of interviewed parents think that the efficiency of modern teaching for acquiring teaching content higher and that with this form of teaching children achieve better results.

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The Impact of Multimedial Form of Presenting the Teaching Content on Perception

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Abstract – One of the challenges of teaching and learning is to achieve the greatest possible effect. The world is changing and with it are changing the factors of teaching too - teachers, students, teaching content and educational technology. Frontal mode is slowly losing space compared with new methods and tools. Multimedia can play a positive role in striving for a better presentation of educational content, as well as improving understanding through the awakening of a deeper motivation and stimulation to maintain attention.

I. INTRODUCTION

Recieving information from the outer world has different characteristics to every living being. The level of recieving, understanding and processing of these information depends on the level of development of the given organism, however it also depends on a bunch of other factors. In this paper human, that is the student will be in the focus of attention from the perspective of learning.

The subject of research of this paper is recieving information through various senses and their effect on learning, with special emphasis on multimedial form of presenting the teaching content and its effect on the perception of the same.

II. THEORETICAL CONSIDERATIONS

A. Learining, remembering, forgetting

"Under the concept of "learning" in the broadest sense we understand the activity of the individual resulting in the acquisition of certain knowledge, skill and habit." [1] (page 11)

Of course this phenomenon is complex and depends on many factors, so it is quite natural that it has been studied since ancient times and from various perspectives.

In order to learn knowledge, attitudes and values are acquired.

Knowledge is the understanding of a concept and the potential ability to apply and use it for some purpose. It includes cognitive processes such as perception, learning, communication and conclusion.

Attitudes are habits and tendencies of reacting in a certain way toward someone or something. They are acquired by learning and upbringing.

Values are human beliefs from different areas (materiality/ spirituality of social life, ethics, morality etc.) which control the behaviour, thinking and experiencing of individuals towards some fundamental characteristics of their environment.

"Perception or observation (Latin Perceptio: receiving, observation) is one of the basic cognitive functions which is a complex and active process of searching, selection, acquisition, processing, organization and interpretation of various incentives which have an effect on the senses and the nervous system." [1] (page 11)

Another definition of observation: "it is the awareness about objects and their characteristics which have a direct effect on our senses." [8] (page 66)

Learning changes people and remembering is the duration of these changes. Remembering has three functions, they are:

- retention (retention of impressions or data)
- reproduction (revision of the things learnt, reproduction of what has once been experienced)
- recognition (identification of what has earlier been experienced or learnt) [1] (page 15)

Sensory memory can be used for a very short term storage of content (about one second) which is registered by exteroceptors (senses). These are important contents with a focus in the short-term memory.

Short-term memory has got limited capacity and is usually limited to 5-7 elements (concepts, notions etc.) The content of short-term memory can be enhanced by conscious activities which help to

transfer information from the short-term to the long-term memory.

Contents in the long-term memory can remain more permanently with the help of analysing, applying and revising them. [1] (page 20)

Forgetting is a phenomenon when some of the acquired attitudes, values and skills disappear from our memory and we cannot reproduce them anymore, or maybe we cannot even recognize them.

Contents based on motor learning are the hardest to forget (swimming, riding a bike, gymnastic exercises, dancing) and they are the fastest information to acquire using higher forms of learning. It is often thought to be forgotten because of the time that has passed, however it is wrong. The main cause of forgetting is the learning of new contents because they make it harder to recall previously learnt ones. Most of the things are forgotten right after the learning of new material and later on less and less. Facts can be forgotten the fastest (dates, names and similar) [8] (page 173)

B. *Receiving perceptional incentives through sensory organs and their impact on learning*

Sensory organs are organs that are set for receiving perceptional incentives.

- sense of sight – receiving light incentives
- sense of hearing – receiving certain types of mechanical incentives
- sense of touch – receiving certain types of mechanical incentives
- sense of smell – receiving certain types of chemical incentives
- sense of taste – receiving certain types of chemical incentives
- other senses – sense of heat, cold, pain, kinaesthetic, static and organic feelings [8] (page 68)

Here the emphasis will be on the senses that are important from the perspective of learning. A survey conducted by the British Association for audio-visual research has shown that people can remember:

- 10% of what they read,
- 20% of what they hear,
- 30% of what they see,
- 50% of what they see and hear,
- 80% of what they say and

- 90% of what they say and do at the same time [9]

Generally speaking, the more senses are involved in perception, the higher the quality and quantity of remembering is. A similar experience is summed up in a Chinese proverb: I hear and I forget; I see and I remember; I do and I understand.

B. Grin talks about three main ways in which students learn:

- the «tell me» method,
- the «show me» method and
- the «involve me» method.

When applying the «tell me» method only verbal information is given so students on the same day forget 90 percent of what they have heard.

The «show me» method besides verbal gives visual information too which help remembering. As a result, it takes longer, but forgetting is still present: about 50 percent of the material is forgotten within seven days, since it is still a passive way of learning – for example «live» presentation and watching videos.

The «involve me» method is a more active way of learning, the student is actively involved in the process of learning and that way learns a lot more and remembers 90 percent of what has been learnt. [7] (page 45)

"In didactics there is a term "didactic triangle" which is made up of the student, the teacher and the teaching content. However in recent times the term "didactic quadrilateral" is even more present which is the triangle supplemented by educational technology. "[1] (page 33)

Educational technology should help enhance successful education and the process of learning, by which is meant:

- Dealing with the student.
- Achieving the previously set educational goals.
- Improving the quality and quantity of learning.
- Organization of forms, resources and methods of work.
- Evaluation of students' work. [1] (page 34)

From a variety of important factors of educational technology for the purposes of this paper I have chosen organization of forms,

resources and teaching methods of work. I will emphasize the multimedial form of presenting the teaching content with appropriate teaching materials.

Today's students are often quite different from their teachers, especially when there is a huge generation gap among them, i.e. they belong to different generations:

- Veteran generation(1925-1945)
- Baby-boom generation (1946-1964)
- X-generation (1965-1979)
- Y-generation (1980-1994)
- Z-generation (1995-2009)
- Alpha-generation (2010-…)

Schools are slowly but surely falling behind in education, because new generations have new skills, knowledge and needs. There is great responsibility on the teaching staff, in order to meet the new requirements of the new generations often a lot of effort is necessary and that they understand their students. The classical position of teachers is almost untenable, new requirements are imposed. The question is how teachers can respond to the requirements of new times, i.e. the requirements of the information society. Of course, there are classifications in terms of teaching staff, too.

An educator in the information society can be:

- digital hermit (totally isolates himself from technology)
- digital researcher (started getting familiar with ICT devices)
- digital nomad (lower level user of computer and the Internet)
- digital settler (ideal citizen of the information society)
- digital conqueror (the Internet is his only source of information) [2]

It is desirable for teachers to reach a higher level in the information society which can be achieved by changing the role of the teacher, the school, by using new teaching materials and teaching methods, by developing new competences. In this process multimedia may play a key role. With the aim of exploring the situation on the field of applying multimedia in my research I have included a survey among teachers so as to have a picture of where the teaching staff is on the upper scale.

III. MULTIMEDIA

A. The concept of multimedia

"Multimedia represents the integration of more than one media (text, sound, video, pictures, animation etc.) that complement each other and enrich information transfer. The essence of multimediality is therefore interactivity as the main feature of media. When this is transferred to the field of teaching situations, then we can say that the application of multimedia in teaching represents broadcasting, i.e. it is the display of pedagogical, educational and teaching content via interconnected interactive media, and provides various methods and forms of learning." [6] (page 2)

To create a multimedia system powerful computers as well as accessories (audio and video digitizers, devices for storing large amounts of data, high-quality communication lines with powerful throughputs, high-quality output devices for presentation, (video projector, etc.) are required.

B. Application of multimedia

It has been mentioned earlier that the traditional way of teaching is no longer sufficient to meet the requirements of today's generation. Computers are present everywhere so they should be applied in teaching as well. The Z-generation takes them quite natural and applies them as a necessary tool of everyday life just as the teaching process. In general, it can affect the increase of motivation and the maintenance of attention. Its great advantage is that it can bring distant and abstract concepts closer to students using animation and simulation, and as such meets one of the basic principles of teaching - obviousness.

The course book is no longer the only form of presenting the teaching content, it is enriched by multimedia elements through ICT and this way the teaching content can be brought more successfully closer to the student.

The role of the teacher also changes by applying multimedia contents. He is no longer the main source of information, he becomes the manager of teaching. To achieve this, he needs to know to handle ICT well.

The student also changes his traditional role. Instead of only remembering the teaching content, he has to learn to take the most important and best things out of it, of course, with the help and guidance of the teacher. [6] (page 5)

C. Multimedia presentations

Multimedia presentations have been so far the most widely used forms of electronic support in the teaching process, and in general, they have been made in PowerPoint. A simpler way is when the presentation is made from the material in the course book and is used to support frontal work. A better way is when the full potential of the application is used so that the slides are filled with information from the Internet, there is animation between them, and they are filled with video and audio contents and simulations, too.

D. Interactive whiteboards

"The interactive whiteboard is an ICT device which combines a computer, a projector, and a screen within one technological system for education. With the help of this system the whiteboard becomes a large sensitive surface managed by a computer. Using a special pen or by touching it every operation is possible on the projected image." [4] (page 62)

"If we compare the educational system of the electronic board with its ancestor (computer, projector, whiteboard or screen) it can be concluded that the biggest advantage of this system is its complete interactivity. Interactivity in the previous case is realized with barriers, when the teacher walks over to the computer and executes the operation. Interactivity is completely achieved in case of the interactive whiteboard because this option provides freedom and obviousness to the teacher – he is not limited by the mouse or the computer keyboard. The image is touch sensitive and this way interactive teaching methods are realized in the classroom. It is possible to perform operations using a special pen or simply touching the board with your finger which are the functions of the mouse (left click, right click, double click, scroll, etc.)" [4] (page 63)

IV. RESEARCH METHODOLOGY

The subject of research is the impact of multimedial form of presenting the teaching content on perception. In the theoretical part of the paper it is pointed out that the application of multimedia has great significance in the process of teaching and learning.

This survey reveals what can contribute to greater teaching performance.

The objective is to determine to what extent the multimedial form of presenting the teaching content affects the perception of the same.

The given results can be used to review teachers' current method of work and to introduce new teaching methods and resources.

The hypothesis of the research is that multimedia improves the understanding of the teaching content.

The task of the research is to determine the attitudes of teachers towards multimedia and to reveal the impact of multimedia on the effectiveness of learning.

It has been conducted in January 2016 in the following primary schools: Doža Đerđ (Gunaroš) and Nikola Đurković (Feketić) on Information Technology lessons with fifth graders, as well as with the teachers of Nikola Tesla primary school (Bačka Topola).

The research has been done with the help of descriptive and experimental methods (experiment with parallel groups). The selected techniques of work were surveying and testing. The used instruments were questionnaires and tests of knowledge.

The interviewing of teachers has been done in the first phase in order to get information about their relationship towards multimedia.

Experiments with parallel groups have been done in the second phase. Two groups of fifth grade students have been formed. The first group was the control group and the second group was the experimental group where the experimental factor of application of multimedia in teaching was introduced.

First the initial states in the groups have been determined with the help of tests, then the groups have been equalized. The factor of multimedia has been introduced in the experimental group (in the control group it has not) and the final testing has been done.

V. RESEARCH RESULTS

A.

TABLE I. TEST RESULTS OF PARALLEL GROUPS

	Group 0 – control (zero)	Group 1 – experimental
The initial average	0.38	0.39
Final average	2.51	3.31
Efficiency	2.13	2.92
Success	0.79	

TABLE II. RESULTS OF TEACHER SURVEY

IMPORTANT				STATEMENT	RIGHT			
1	2	3	4		1	2	3	4
1	1	9	4	1. I use frontal method of work.	2	1	9	2
2	4	4	4	2. I use group work (or pair work)	3	3	5	3
2	0	7	5	3. I use individual work.	2	2	5	5
1	0	6	7	4. I use verbal teaching resources.	2	2	5	5
1	2	4	7	5. I use textual teaching resources.	1	4	3	6
2	5	3	4	6. I use audio teaching resources.	2	6	3	3
1	0	6	7	7. I use visual teaching resources.	2	1	6	5
1	3	7	3	8. I use electronic teaching resources.	3	5	4	2
1	3	4	6	9. The computer is an important teaching resource.	2	5	4	3
2	7	3	1	10. I apply electronic learning.	4	6	3	1
1	4	6	3	11. The concept of multimedia is clear for me.	0	6	6	2
1	2	2	9	12. I know what the principle of obviousness is.	3	1	4	6
1	4	5	4	13. I use multimedia presentations.	2	5	6	1
2	2	4	6	14. In addition to texts and images, my presentations include animations, audio and video clips.	3	5	2	4
4	5	3	2	15. I use an educational computer software.	6	5	1	2
4	2	6	2	16. I use tutorials.	6	2	4	2
3	2	6	3	17. I use an interactive whiteboard.	9	1	2	2
1	2	2	9	18. Technical requirements (being equipped with the necessary technique) are the biggest factor in the application of multimedia.	2	2	6	4

B.

VI. INTERPRETATION OF RESEARCH RESULTS

Interpretation of the research results of parallel groups

After the initial testing the groups have been equalized by eliminating one student from the control group and three students from the experimental group which resulted in equalized averages of 0.38 (control group) and 0.39 (experimental group). The difference of 0.01 is due to the impossibility of total equalization in the form of removing a combination of other students. Final test averages justified the expectation that the use of multimedia in the teaching process will increase success. The final average in the control group is 2.51 and in the experimental group it is 3.31 which gives an efficiency of 2.13 in the control group, that is, 2.92 in the experimental group. The difference between the efficiency of the two groups is successfulness which is 0.79, that is, 37%.

The given results justify the hypothesis that multimedia improves the understanding of the teaching content, because efficiency increased by 37% in the experimental group where the teaching material was presented using multimedia.

Interpretation of the results of teacher survey

The following statements are of key importance to teachers: statements about the principle of obviousness (12), about the technical requirements as the biggest factor in the application of multimedia (18), about verbal (4) and textual teaching resources (5). The use of tutorials (16) and educational computer software (15) is not important for them.

The picture is somewhat different if we look at the presence of the statements in practice. The following statements are completely present: that they use textual teaching resources (5) and that they use the principle of obviousness (12). The use of frontal method of work (1) is present to a greater extent. The use of the interactive whiteboard (17), tutorials (16) and educational computer software (15) are not present at all.

Based on the above results, it can be said that the traditional way of teaching still prevails, new methods and teaching aids are underutilized. Teachers recognise that the use of multimedia presentations (14) is of great importance, however this statement is to a smaller extent present in practice.

VII. CONCLUSION

One of the goals of the teaching process is to be achieved with the best possible performance. In addition to the many factors that influence it one could be the use of multimedia in order to better understand the teaching content. With the help of this research it has been justified that the multimedial form of presenting the teaching content increases the success of teaching and learning. With an additional research in this paper it could have probably been proven that students prefer lessons with multimedia and the interactive whiteboard. This fact can have a beneficial effect on students' motivation and maintenance of attention. Examples for such research can be found in the bibliography references [4].

This paper has proven the favourable impact of multimedia, however with the teacher survey it has revealed some facts about the true state of application of multimedia in teaching. On the one hand, teachers are aware of the importance of multimedial form of teaching, on the other hand their practice shows something else: they barely use new methods and teaching aids. This might be encouraged by the factor that the technical conditions are unfavourable (there are few computers, projectors, interactive whiteboards, etc.). If the technical conditions were more favourable, most teachers would probably use their potential. For now, unfortunately there is a gap between the clear favourable way towards increasing teaching performance and actual possibilities regarding the available technique. In this field there is a huge room for improvement.

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LMX as a Moderator on the Correlations Between School Cultural Dimensions and Quality of Teaching Dimensions

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Abstract This paper presents the results of a research into the moderating effect of Leader-Member Exchange (LMX) on the correlation between school culture dimensions and those for quality of teaching. From results of this research we should identify the impact of the quality of the relationship with the principal (through school culture) to the dimensions in which the moderator effect of LMX was confirmed. This knowledge could provide a crucial foundation for determining teacher higher-education curriculum elements, based on the school experience.

I   INTRODUCTION

The motivation for this study lay primarily in the desire to highlight moderating effect on the correlation between school culture dimensions and those for quality of teaching. From this we should identify the impact of the quality of the relationship with the principal (through school culture) to the dimensions in which the moderator effect was confirmed This knowledge could provide a crucial foundation for determining teacher higher-education curriculum elements, based on the school experience.

Legislation generally does not define the concept of school culture, and it occurs as a term only in scientific theory. However, theorists see the culture of schools as a very real and present factor, and as an influential kind of cultural phenomenon, and school itself, according to Patterson, Purkey & Parker, 1986, as culturally dependent. School culture in the early twentieth century is defined as a complex pattern of norms, attitudes, beliefs, behaviours, values, ceremonies, traditions, and myths that are deeply ingrained at the very core of the organization. It is the historically transmitted pattern of meaning that wields astonishing power in shaping what people think and how they act (Barth, 2002). Everyone who visits a school can sense its culture at every given step: through the behaviour of its employees, the appearance of the walls in the corridors, or the presence or absence of shouting from pupils (Pavlović & Oljača, 2011).

The impact of school leadership on the organizational culture of a school is inevitable. The most developed periods can often be connected to a specific school principal. Fisher, Frey and Pumpian (2012) emphasize the important role that the school principal has on the formation of the culture of a school. According to Deal & Peterson, 1990, each of the principals described and identified what was important, selected compatible teachers, dealt successfully with conflict, set a consistent example, told illustrative stories, and used ceremonies, tradition, rituals, and symbols to display the school's common values. In addition, the role of the school principal and the strategy employed for managing a school and his/her impact in terms of motivating teachers to improve the quality of their teaching are referred to (Champo, 1993). Collaborative school cultures are perceived more and more as being essential for better schools. Therefore, one of the important roles of a principal should be that of culture builder. Results from this secondary analysis suggest that principals could foster collaborative cultures by applying certain strategies. However, this study also indicates that the way principals should use the strategies depends on the level of teachers' motivation and commitment. The strategies which appear to be important and the attention to be given to teachers' needs, motivation and commitment seem to agree with the components associated with transformational leadership. The school principal is a person who must have something to cling to (White cited in Grogan, 2013).

In modern educational research, the concept of teaching quality is viewed according to its conceptual, empirical and normative properties. One relevant piece of research was carried out in Australia in 2005, by Fenstermacher and Richardson (2005). The concept was analysed and observed according to aspects related to the objectives and tasks involved in teaching, the work of teachers and actual student achievement. Analysis showed that good teaching is not the same as successful learning,

and neither does one logically entail the other. The quality of educational processes affects a number of other factors that are beyond the scope or control of the teacher in the classroom.

The association between school culture and teaching has become an area of interest to experts, especially since the nineties. Relevant concepts of school culture developed according to two available types - ideal school culture and dynamic school culture. The ideal school culture is based on two basic dimensions, while a dynamic type is based on five underlying structures. Both are discussed for their heuristic, conceptual, methodological and explanatory potential in researching the fields of school effectiveness and school improvement (Hargreaves, 1994).

Leader-Member Exchange (LMX) theory is the broadest leadership theory (Goertzen & Fritz, 2004). The essence of this theory lies in measuring the quality of leader-member relationships and mutual trust (Seabright, Leventhal & Fichman, 1992). High-quality LMX involves mutual support, the exchange of formal and informal rewards (Dienesch & Liden, 1986), mutual trust, respect, mutual influence, loyalty, affiliation and a feeling of duty to one's leader (Graen & Uhl-Bien 1995). Such a relationship goes beyond the requirements prescribed by an employment contract. Contrary to this, low-quality LMX denotes a relationship which is economic and contractual, where the leader-member exchange does not go beyond the stipulations of the employment contract (Sparrowe & Liden, 1997).

Focusing on school leadership relations between principals and teachers, this study examines the potential for their active collaboration around instructional matters to enhance the quality of teaching and student performance. The analysis is grounded in two conceptions of leadership - transformational and instructional. The sample comprises 24 nationally selected restructured schools - 8 elementary, 8 middle, and 8 high schools. In keeping with the multilevel structure of the data, the primary analytic technique is hierarchical linear modelling (HLM). The study finds that transformational leadership is a necessary but insufficient condition for instructional leadership. When transformational and shared instructional leadership coexist in an integrated form of leadership, the influence on school performance, measured by the quality of its pedagogy and the achievement of its students, is substantial (Marks & Printy, 2003).

The previous presentation can be summarized as follows: the culture of the school and the teaching

and learning process are a significant segment of the educational process. The degree of development where culture in schools is concerned affects many aspects of the institution. The quality of teaching and learning represents an important issue, and the impact of the school is under the influence of different factors.

Based on the above considerations, the following hypotheses were set up in this paper:

Leader Member Exchange (LMX) has a moderating effect on the correlation between school culture dimensions and quality of teaching dimensions in primary schools in Serbia.

II   RESEARCH METHODOLOGIES

A   Survey instruments (measures)

School culture. The School Culture Survey (SCS) (Saphier & King, 1985; as modified by Edwards, Green & Lyons, 1996) was used as an instrument for measuring school culture. The survey comprises three dimensions, containing 24 items, using a five point Likert scale (1 - Almost never; 2 - Less often than not; 3 - About half the time; 4 - More often than not; and 5 - Almost always). The dimensions are: Teacher Professionalism and Goal Setting (10 items), Professional Treatment by Administration (8 items) and Teacher Collaboration (6 items).

The teaching process. The measuring instrument for the teaching process is the questionnaire manual for the evaluation and self-evaluation of school activities, from the Ministry of Education and Sports of the Republic of Serbia in cooperation with the British Council in Serbia and Montenegro (Bojanić et al., 2005). The names of the teaching dimensions can be seen in Table 1.

Leader-member exchange (LMX). To measure LMX quality in this research, we used the LMX-7 questionnaire. The instrument consists of seven items, and in their evaluation the respondents used five-point Likert scales (Graen & Uhl-Bien, 1995).

B   Participants and data collection

The research was held in Serbian primary schools. The survey was conducted using questionnaires. A total of 383 teachers from 57 schools answered the questions. 21 questionnaires were rejected. Thus, the final number of respondents was N = 362. The survey included schools in the northern part of Serbia. This area was chosen because of its geographical proximity of the authors.

In the sample of 362 respondents, 250 were women and 112 men. This small number of men in the sample is a consequence of the structure of

employment in education in Serbia (according to gender). According to the Statistical Office of the Republic of Serbia, 2011, 67% of those employed in education are women and 33% men. According to age, respondents were divided into three groups: younger teachers up to 35 years of age, middle-aged teachers (35 to 50 years old) and older teachers (over 50 years of age). The age of the respondents was as follows: 93 younger teachers, 197 middle-aged teachers and 72 older teachers.

III   RESULTS

A Descriptive Statistics

Descriptive statistics for the dimensions of school culture, the dimensions of teaching and LMX is shown in Table 1. In this the table, among others the names of the dimensions, the short name for each dimension (which is used below), mean size, standard deviation and Cronbach's alpha for each dimension are given. Cronbach's alpha values range in the interval from $\alpha = 0.887$ to $\alpha = 0.949$.

Table 1   Descriptive statistics

	Index	Min	Max	Mean	Std. Deviation	Cronbach's
Teacher Professionalism and Goal Settings	SC1	1.10	5.00	3.9390	.81384	.949
Professional Treatment by Administration	SC2	1.00	5.00	3.7510	.83444	.919
Teacher Collaboration	SC3	1.00	5.00	3.8310	.83305	.892
Lesson planning	TP1	1.00	4.00	3.5104	.44618	.815
Preparation for Classes	TP2	1.57	4.00	3.6022	.39925	.889
Communication and Cooperation	TP3	2.13	4.00	3.8612	.28568	.875
Rationality and Organization	TP4	2.25	4.00	3.6878	.35395	.856
Encouraging Pupils	TP5	2.00	4.00	3.7667	.32740	.879
Correlation and Application of Knowledge	TP6	2.20	4.00	3.6376	.41565	.741
Responsibilities of Pupils	TP7	2.00	4.00	3.6309	.41753	.794
Method of Learning	TP8	2.29	4.00	3.7384	.35512	.854
Monitoring and Evaluation	TP9	2.36	4.00	3.7717	.32084	.884
Reporting	TP10	1.60	4.00	3.6365	.47566	.861
Personal Development of Pupils	SPD	2.13	4.00	3.7195	.33116	.884
Ethical Development of Pupils	SED	2.33	4.00	3.6398	.37574	.887
Leader-Member Exchange	LMX	1.00	5.00	3.8599	.93278	.943
Valid N (listwise)	362					

B   Regression Analysis

Multiple Regression analysis was used to determine the predictive effect of school culture dimensions (independent variables) on the teaching process (dependent variable). Results from the regression analyses are presented in Table 2. In Table 2 the bold values point to statistically significant coefficients.

Table 2   Regression analysis (Dependent Variable: TP dimensions; Predictors: SC dimensions)

Dependent	Independent	B	T	Sig.	R²	F	F Sig.
TP1	**SC_1**	.343	2.924	.004	.238	37.173	.000
	SC_2	.099	.835	.404			
	SC_3	.063	.765	.445			
TP2	SC_1	.236	1.945	.053	.186	27.316	.000
	SC_2	.123	1.008	.314			
	SC_3	.093	1.100	.272			
TP3	**SC_1**	.348	2.704	.007	.079	10.305	.000
	SC_2	-.040	-.306	.760			
	SC_3	-.040	-.439	.661			
TP4	**SC_1**	.338	2.727	.007	.148	20.785	.000
	SC_2	.076	.605	.545			
	SC_3	-.028	-.324	.746			
TP5	**SC_1**	.399	3.209	.001	.141	19.557	.000
	SC_2	.034	.275	.784			
	SC_3	-.071	-.816	.415			

TP6	SC_1	.123	.957	.339	.082	10.606	.000
	SC_2	.086	.660	.510			
	SC_3	.093	1.030	.304			
TP7	**SC_1**	.282	2.227	.027	.109	14.599	.000
	SC_2	-.038	-.299	.765			
	SC_3	.097	1.091	.276			
TP8	**SC_1**	.279	2.187	.029	.097	12.762	.000
	SC_2	-.023	-.179	.858			
	SC_3	.063	.703	.482			
TP9	**SC_1**	.388	3.125	.002	.145	20.202	.000
	SC_2	-.044	-.350	.727			
	SC_3	.039	.451	.653			
TP10	**SC_1**	.368	2.982	.003	.157	22.187	.000
	SC_2	.022	.174	.862			
	SC_3	.011	.123	.902			
SPD	**SC_1**	.267	2.169	.031	.161	22.945	.000
	SC_2	.136	1.096	.274			
	SC_3	.009	.102	.919			
SED	**SC_1**	.372	3.300	.001	.293	49.471	.000
	SC_2	.147	1.296	.196			
	SC_3	.037	.469	.639			

C LMX as a moderator of the relationships between school culture dimensions and the quality of teaching dimensions

Table 3 shows the results of correlation analysis, school culture dimensions, and the quality of teaching, especially for teachers who expressed a high (HLMX - High LMX) or low (LLMX - Low LMX) level in terms of their relationship with the school principal. Prior to commencing the examination, the sample of N = 362 respondents was divided (by median) in half according to those with high LMX (HLMX) and those with low LMX (LLMX). Thus, both groups feature 181 respondents.

Table 3 Correlation coefficients between school culture dimensions and quality of teaching dimensions for high and low LMX

HLMX	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10	SPD	SED
SC1	.443**	.432**	.307**	.411**	.361**	.289**	.238**	.272**	.342**	.400**	.356**	.434**
SC2	.449**	.399**	.245**	.387**	.334**	.304**	.233**	.250**	.275**	.377**	.358**	.422**
SC3	.406**	.402**	.166*	.340**	.267**	.230**	.213**	.226**	.218**	.308**	.254**	.311**
LLMX	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10	SPD	SED
SC1	.382**	.300**	.180*	.248**	.261**	.159*	.241**	.229**	.275**	.244**	.259**	.450**
SC2	.337**	.297**	.147*	.212**	.215**	0.141	.195**	.190*	.240**	.200**	.237**	.420**
SC3	.298**	.255**	0.134	.157*	.159*	.180*	.217**	.195**	.242**	.188*	.223**	.390**

To test the moderating effects of LMX, Hierarchical regression analysis was used. This type of analysis was used to examine the significance of the regression coefficient on the product of predictor variables for the independent variable TPi, the dependent variable SCi and the moderator variable LMX. The results of the hierarchical regression analyses are presented in Table 4, but only the results that confirm the moderator effect of LMX.

Table 4 Hierarchical regression analysis with LMX as a moderator (only pairs where a moderating influence of age on the correlations between some SC dimensions and some TP dimensions is confirmed)

Independent	Dependent	R	F-change	Sig. F
SC_1		0.179	78.474	0
	TP2	0.182	1.141	0.286
		0.197	6.775	0.01
	TP3	0.078	30.643	0
		0.083	1.682	0.195

		0.106	9.402	0.002
		0.147	62.246	0
	TP4	0.158	4.606	0.033
		0.187	12.773	0
		0.139	58.221	0
	TP5	0.144	1.95	0.163
		0.159	6.525	0.011
		0.076	29.696	0
	TP6	0.077	0.395	0.53
		0.09	4.934	0.027
		0.157	66.855	0
	TP10	0.16	1.246	0.265
		0.175	6.585	0.011
		0.158	67.534	0
	SPD	0.159	0.55	0.459
		0.182	10.094	0.002
		0.213	97.672	0
	TP1	0.216	1.018	0.314
		0.228	5.588	0.019
		0.171	74.212	0
	TP2	0.173	0.86	0.354
		0.191	7.987	0.005
		0.06	23.133	0
	TP3	0.062	0.444	0.505
		0.081	7.645	0.006
		0.13	53.851	0
	TP4	0.137	2.951	0.087
		0.169	13.819	0
SC_2		0.116	47.275	0
	TP5	0.118	0.626	0.43
		0.133	6.463	0.011
		0.075	28.999	0
	TP6	0.075	0.369	0.544
		0.093	6.747	0.01
		0.133	55.424	0
	TP10	0.14	2.788	0.096
		0.157	7.177	0.008
		0.149	62.997	0
	SPD	0.151	0.852	0.357
		0.176	10.701	0.001
		0.176	76.851	0
	TP1	0.194	8.187	0.004
		0.206	5.233	0.023
		0.147	61.973	0
	TP2	0.148	0.635	0.426
		0.173	10.44	0.001
		0.044	16.506	0
	TP3	0.045	0.333	0.564
		0.063	6.855	0.009
		0.094	37.142	0
SC_3	TP4	0.094	0.084	0.772
		0.122	11.336	0.001
		0.078	30.392	0
	TP5	0.081	1.253	0.264
		0.099	7.182	0.008
		0.086	34.014	0
	TP10	0.089	1.03	0.311
		0.099	4.134	0.043
		0.112	45.213	0
	SPD	0.128	6.966	0.009
		0.139	4.42	0.036

IV   DISCUSSION

Table 2 presents the results of multiple regression analysis for determining the predictive effect of school culture dimensions (independent variables) in the teaching process (dependent variables). There are the relatively high values of the corrected determination indexes R^2, which range from 0.079 to 0.238. According to the values of R^2, the next dimensions of teaching and learning are under the greatest influence of school culture: TP1 - Lesson Planning ($R^2 = 0.238$) and TP2 - Preparation for classes ($R^2 = 0.186$). In Table 2 it can be seen that among the dimensions of the culture of the school, the strongest predictive effect on teaching and learning is seen for dimension SC1 - Teacher Professionalism and Goal Setting (also in line with the results of the correlation analysis). Specifically, Table 2 shows that the dimension SC1 - Teacher Professionalism and Goal Setting has a strong predictive effect on most dimensions of teaching quality: TP1 - Lesson Planning, TP3 - Communication and Cooperation, TP4 - Rationality and Organization, TP5 - Encouraging Pupils, TP7 - The Responsibility of Pupils, TP8 - Method of Learning TP9 - Monitoring and Evaluation, TP10 - Reporting, SPD - Pupils' Personal Development and SED – the Ethical Development of Pupils. The professionalism of teachers and the achievement of objectives directly function towards better results from the work of teachers, and they are precisely reflected in the quality of teaching and pupil development, both personal and ethical. Among other factors, the dimension SC1 - Teacher Professionalism and Goal Setting applies to teachers: a professional approach, awareness among teachers of their own imperfections and striving towards continuously expanding their professional and pedagogical knowledge, taking the initiative and putting forward new ideas to improve the teaching process, working as a team and having a shared responsibility for students, effectively setting up and analyzing individual and common goals that lead to the achievement of the mission of the school. All this leads to a significant predictive effect of SC1 - Teacher Professionalism and Goal Setting on the dimensions of the quality of teaching.

On the other hand, SC2 - Professional Treatment by Administration has no significant predictive effect on the learning process. This can be interpreted as follows: the quality of teachers in the educational process is not significantly influenced by the way quality control functions are performed in the school, administrative tasks, the variety of extracurricular activities or the level of understanding and respect they encounter in their schools. In other words, the teachers can be satisfied or dissatisfied with the administration of the school, the business aspects of the school and understanding on the part of management, but this does not affect the quality of their work in the classroom: a good teacher is always a good teacher, it does not depend on the quality of the dimensions SC2 - Professional Treatment by Administration.

Similarly, SC3 - Teacher Collaboration also has no significant predictive effect on the learning process. The teacher is alone in the classroom: he may or may not respect the opinions of his/her colleagues in order to work with them to a greater or lesser extent, but it does not affect the teacher's results in achieving quality in teaching. If teachers do not cooperate, it's because they think it's the right path to take, and this does not mean that they do not try to work well, it just means that they have a personal attitude towards the implementation of the teaching process.

Table 3 shows that there is generally a strong correlation between school culture dimensions and quality of teaching dimensions, both when LMX is high (HLMX), and low LMX (LLMX). Further analysis, the results of which are shown in Table 4 (Hierarchical regression analysis), indicates the significant effect of the moderator effect of LMX on the observed relationship. Hierarchical regression analysis showed 22 relations (out of 36 in this case) in which there are moderating effects of LMX. Given that the moderator effect of gender is present in most of the relationships, it can be concluded that hypothesis H3 is confirmed.

On the basis of the correlations for HLMX and LLMX (Table 3), it can be seen that the moderator effect of LMX, as a rule and in all relations, has the following direction: in HLMX, dimensions of school culture influence the quality of teaching dimensions more than at LLMX. Generally, it can be concluded that high LMX creates a school culture that has a strong and positive impact on the educational process and personal development of pupils. In cases where LMX is low, the impact of school culture on the teaching process is weaker. In other words, when LMX is low, then the learning process is influenced more by other factors, such as the personal attitude and approach of teachers, their self-motivation and conscience. Further analysis confirmed this assumption.

It should be noted that the moderator effect of LMX is concentrated around certain quality of teaching dimensions. This means that, in the majority of the quality of teaching dimensions, the moderator effect occurs simultaneously in all three dimensions of school culture. So we can talk about the (almost) complete moderator effect of LMX in

school culture relations (overall culture of the school) and the individual dimensions of quality of teaching, as well as the complete absence of the moderator effects of LMX in school culture relations and other dimensions of the teaching process. Quality of teaching dimensions in which there is the moderator effect of LMX are: TP1 - Lesson Planning, TP2 - Preparation of Classes, TP3 - Communication and Cooperation, TP4 - Rationality and Organization, TP5 - Encouraging Pupils, TP6 - Correlation and Application of Knowledge, TP10 - Reporting and SPD - The Personal Development of Pupils. On the other hand, the moderator effect of LMX does not exist at the following quality of teaching dimensions: TP7 – Responsibility of Pupils TP8 – Method of Learning TP9 - Monitoring and Evaluation and SED - The Ethical Development of Pupils.

It may be noted that the moderator effect of LMX does not exist in relations between school culture and those dimensions of teaching where the influence of a teacher's individuality is significantly expressed. This refers primarily to their unique and specific approach, which is especially present in the means of monitoring and evaluation (TP9), but also with the developing of pupil responsibility (TP7), pointing pupils towards techniques and ways of learning (TP8) and the ethical development of pupils (SED). It is obvious that the method of assessment, and the extent to which pupils are encouraged to be responsible, as well as the search for the best way of achieving learning and ethical development for pupils, are mainly influenced by the teacher. Competencies are related to knowledge, skills, abilities, attitudes, motivational dispositions and the principles of professional ethics necessary for successful teaching. In addition, through professional development programmes, teachers build professional knowledge, develop their thinking and attitudes, correct them, develop communication techniques with pupils, and learn the manner and method of learning, assessment, and the ethical development of students. Therefore, in these dimensions of teaching, there is no moderator effect from the quality of the relationship with the principal.

At the other dimensions of the teaching process (the dimension where there is the moderator effect of LMX), to a greater or lesser extent there are components that include: quality of the teacher's work, the formal implementation of the stipulated obligations, organization and commitment before and during a class, as well as the commitment and motivation of teachers. This shows that, in relation to the dimensions of teaching where there is no moderator effect of LMX, the dimensions of

teaching where there is a moderator effect of LMX, contain components that are less influenced by personal attitudes and approaches on the part of teachers, and more influenced by the culture of the school. As the principal of the school is essentially a manager and indeed the top manager of the school, his or her role in creating its culture is very important. From this we can identify the impact of the quality of the relationship with the principal (through school culture) to the dimensions in which the moderator effect was confirmed.

V   CONCLUSION

Research has shown that leader member exchange (LMX) has a moderating effect on the correlation between school culture dimensions and those for quality of teaching. High LMX builds a school culture that raises the level of teaching quality. Based on these findings, it can be concluded that hypothesis has been confirmed.

The limitation of this study is that the results are relevant to primary schools in Serbia. However, the results are important for understanding and improving observed relationships and processes, and may also be useful for comparison with other countries and reaching analogous conclusions.

This result can be seen as expected and logical. It could be said that LMX has a moderator effect in all situations where this is an actual possibility. This does not mean that the principal can or should not have some influence over the dimensions of teaching where there is no moderator effect of LMX. It simply means that the impact is not the direct responsibility of the principal in his or her direct role as manager. Other colleagues and the work they do can encourage teachers to develop their own opinions and views, and to correct them when it comes to the responsibility of pupils, the way of learning, assessment, and the ethical development of pupils. At the same time, the principal may adopt this role.

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Text Processing in Analysis of Students' Attitudes

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Abstract –This paper presents appliance of text processing in analysis of students' attitudes. Research was conducted at Faculty of Technical sciences Čačak. Results show that mentioned techniques could be successfully used in analysis of different questionnaries. Future work is related to further research in text mining field.

I.   INTRODUCTION

The analysis of students' attitudes represents a starting point for the organization and improvement of education. Analysis, via surveys, implies further statistical processing and analysis of results over different statistical parameters.

In this research, text processing is used for the purpose of alternative processing of the survey and student responses. This kind of processing is very suitable for unstructured documents, such as Microsoft Word.

Text processing belongs to one of the processes that is represented in text mining. According to [1] "text mining is the technology which discovers patterns and trends semi-automatically from huge collections of unstructured text". It is based on several following technologies, Natural Language Processing (NLP), Information Retrieval (IR), Information Extraction (IE), and Data Mining (DM) [2].

In case when students are required to write a response in the form of an essay or an open-ended response, it is necessary to analyze unstructured documents such as Microsoft Office Word, as is the case in this study.

Text mining techniques have been successfully used in the analysis of sentiments (sentiment analysis), and they can also be very effectively used in the analysis of student attitudes.

There are a large number of studies dealing with the application of text mining techniques or text processing in order to gain the results of the analysis of users attitudes.

In the paper [3] text mining techniques are used in order "to examine the potential benefits of text mining in the field of language education and its effectiveness in extracting meaningful information from student portfolios in order to provide useful feedback to students and the educational community" [3].

In a research given in [4] sentiments analysis is shown, the proposed algorithm is implemented and performance is tested. Users attitudes about the films were analyzed, unlike the proposed research where students' attitudes are analyzed.

Opinion mining is successfully used for the evaluation of courses in relation to the „students' attitudes posted on Internet forums, discussion groups and/or blogs, which are collectively called user-generated content", according to [5].

In relation to the shown research, the proposed approach differs in application of techniques, and the purpose of the research refers exclusively to the analysis of students' attitudes.

II.   METHODOLOGY

The purpose of the research is related to the determination of possibilities of using text preprocessing in the analysis of student survey.

Research tasks:

- Creation of the surveys
- Selection of the samples
- Organisation of the survey
- Analysis of the results
- Discussion of the results

The software RapidMiner was used for analysis [6].

The third-year students of Techniques and Informatics at the Faculty of Technical Sciences in Čačak were surveyed. The sample is 30. Students gave the response of open type to the question what are they going to do after graduation.

The survey was conducted within the program RapidMiner, where the new process has first been created, which consists of loading data from a file. In Figures 1 and 2 starting layout of the processes of Read document and Process document are shown as well as the Selection of the documents with the contents of the students' responses.
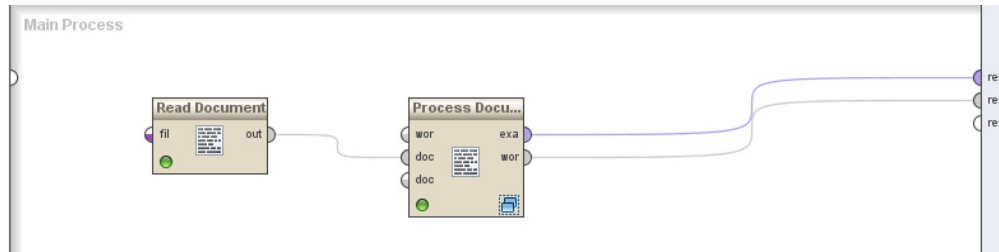
Figure 1. Display of the processes layout of Read document and Process document
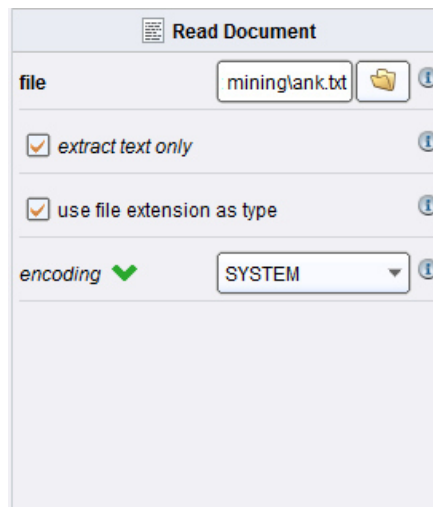
Figure 2. Display of the documents reading from the selected location

After downloading of the document, Process Document is closer defined as the appropriate commands are added when proceeding, shown in the figure 3.
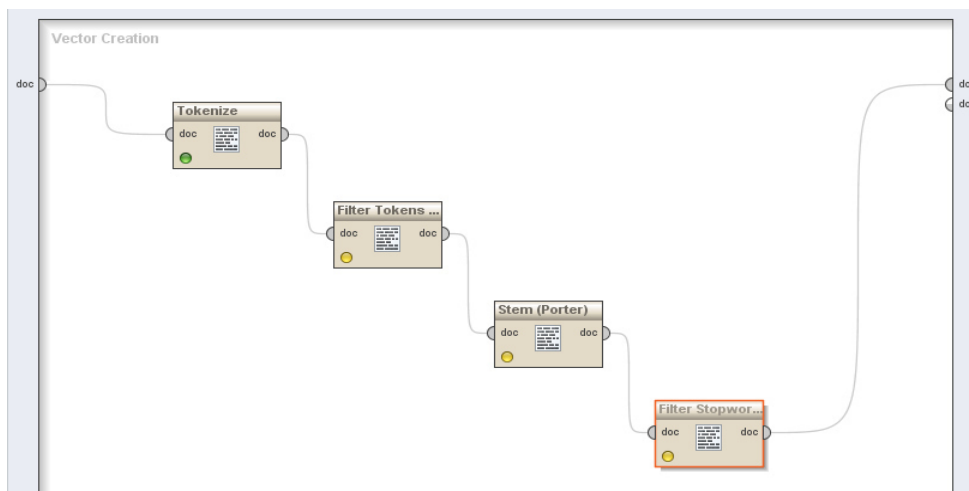
Figure 3. Display of the operators within the Process Documents

RapidMiner has a large set of text processing operators available. We used four of them to create word vector list.

1) Tokenize – splits the texts of a document into a series of words or tokens. We will use the 'non-letters' mode which will generate single word tokens but other options are available.

2) Filter Tokens – we can filter tokens or words (in word mode) by length.

3) In the Filter Tokens parameter panel we set the minimum to 4 and the maximum to 25. Obviously, depending on your context be careful not to exclude important words.

4) Stem (Porter) – stemming is a very important concept in natural language parsing. It allows one to reduce words to their base or stem. The aim of stemming is to reduce related forms of a word to a common base form. i.e. fishing", "fished", "fish", and "fisher" to the base word, "fish". One of the most popular stemmer is the Porter stemmer.

5) Filter Stopwords – this operator removes common English words such as 'a' and 'the' etc. Word like these is very noisy unless removed.

Figure 4 shows the additional settings within Process Documents.
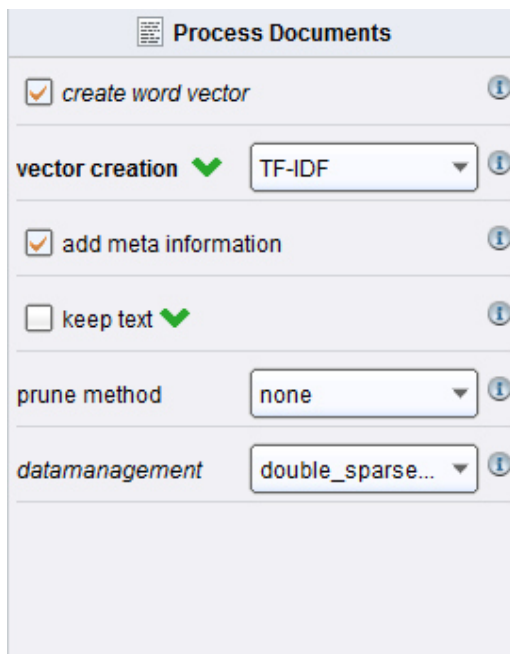
Figure 4. Settings for Process Documents

III. RESULTS AND DISCUSSION

This section presents the results obtained by machine processing of the survey results, by the software Rapid Miner.

Figure 4 shows an overview of part of the results relating to the number of occurrences of certain words in the context of student responses.

Figure 4. Display of frequency of the words occurrence

After examining the results it was found that the majority of students want to work in education, and they want to be teachers of informatics.

In the second place, but to a much lesser extent, students want to be administrators of the system or to deal with the Web design.

IV. CONCLUSION

Bearing in mind the shown results, conclusions can be made in the direction of the possibilities of preprocessing application in the surveys analysis compared to manual analysis. This analysis provides an overview of the particular words frequency with the possibility of removing of punctuation and other characters or types of words that has no impact on the result (contributions, suggestions, etc..).

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Analysis of the Standards of Primary School Students' Achievement in Their Final Examination

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Abstract - The subject of the research achievement of pupils in the final exam in elementary school. As stated in the theoretical part of the work, pupil achievement in the final examination at the end of compulsory education and upbringing is of particular importance for both the pupils and for the school, because the results of the exam are used to improve education were in elementary school, except evaluative tool, final exam, there is a certification and selection function. Which means that pupils upon completion of the exam receive a certificate of completion of elementary school and the results of final exam affect the selection of pupils for enrollment in secondary schools?

I. INTRODUCTION

The final exam, which assesses the degree of achievement of general and specific standards of achievement in primary education, under Article 82 of the Law on the Foundations of the education system, taken by all pupils at the end of the eighth grade. Pupils with disabilities and disabilities take the final exam, in accordance with their capabilities, and in appropriate conditions [1]. Members of national minorities who obtain primary education in their mother tongue, have the right to sit in their native language. After completion of the final exam the pupil is issued a public document, or a certificate of final exam performed. Pupil also acquires the right to enroll in secondary school without taking qualifying exams, in addition to the entrance examination to verify the exceptional abilities in a manner and procedure prescribed by a special law. The final exam consists in a taking an exam of the native language (Serbian) and Mathematics and the combined test [4].

During the final exam all pupils have exactly the same treatment, and the same assessment criteria. Ministry of Education and Science, the Institute for Education Quality and Evaluation, as well as employees in the school administration are tasked to conceptualize, develop, organize and conduct final exams [4]. Pupils should first get complete information and notification of the final exam. To prepare the final exam were made collections of native languages, Mathematics combined test, in order to put pupils indicative material that may be on the exam. Tasks that are made in the context of the final exam are classified into three categories or levels:

- Basic level;
- Intermediate level;
- Advanced level [2].

Special attention must be paid to the control examination to reduce any possible mistakes. It is very important that after the examination and the school is sent less complaints and appeals on the results.

The great advantage of the implementation of final exams is that all pupils are in the same position and are equal to each other. The grading system is the same for all. How do the tests work and handover under codes, and testing for encrypted, thus prevented the possibility of abuse of that evaluation criteria are different. Prior to the final exam in school should be set up detailed information and instructions about the exam. The organization of the examination is such that the exams were closed to the public. After the examination is carried out the duties, decrypt and finally get some results and number of credits pupils have won in the course of the examinations in the mother tongue, mathematics and kombiovanog test. Based on the resulting number of points need to be analyzed and compared with the results of examinations of previous years. There should be a reference to what to do and what activities and applies and measures taken to improve and advance the quality. Pupils receive after passing the appropriate certificates that represent a mandatory document to the testimony of enrollment in secondary schools [3].

The basic functions of the final exam are:

- Certification - based on the deposit of an elementary school issued a document (certificate) that the pupil has completed exams in primary education;

- Selection of pupils - on the basis of the results achieved, and the number of credits a pupil has the opportunity to enter one of the medium of available school. Those who have earned a higher score have far greater opportunities compared to those who have made a small number of points;

- The control function - contributes to the control of the tested system of education, and schools;

- motivational function - pupils who consider exam requirements unrealistic they can not be motivated by little, while the pupils in which there is a goal, reward or intention they are motivated;

- monitoring the achievement of educational standards - can be presented as a pass rate of pupils at the said examinations. Exam results are taken as the success of teachers and schools [5].

II. RESEARCH METHODOLOGY

A. Research problem

This research reveals the extent to which pupil standards achieved at the end of primary education in a school year and comparison of these results with the results from previous years.

B. The aim of the research character

The aim of this research is the empirical determination of the total pupil achievement on the final exam which is conducted in elementary school.

Due to the small number of survey respondents belong to small, micro research and because studies teaching practice falls within the empirical.

The data obtained can be used on this occasion for a review of the operation and the launch of new activities to improve teaching.

C. Research Tasks

Research tasks are:

- Determine the overall pupil achievement in the final examination

- Determine Pupil achievement in the final examination for the previous four school years.

D. Research hypothesis

Due to the pre-determined goal and tasks of research starting from the following general hypothesis: Total pupil achievement in the final examination in elementary school varies depending on the school year.

E. Research methods

The method applied in this study was selected according to the nature of the problem, object, goals and tasks of research, and in accordance with the set hypotheses. It is a descriptive method with longitudinal access.

F. Techniques and instruments

In this study, the technique of analysis tests rescued from the final exam in Serbian language and Mathematics, a primary goal of this method is to arrive at an objective given facts relevant to the subject of study and research.

The instrument used for data collection is a test from the final exam in Serbian language and Mathematics for four school years.

G. Population and sample of survey

The population is a basic set from which the sample is taken. In this study population consisted of pupils of "Dr Boško Vrebalov" Melenci.

Research conducted for the past five school years from 2010/11 schole year until 2014/15 school year, and include 254 pupils in final grade of primary school "Dr Boško Vrebalov" Melenci.

III. RESEARCH RESULTS

The research results are presented in tables and charts. It can clearly see the average number of points and the levels of pupil achievement in the final examination.

Analysis of the test carried out by the Institute for Evaluation of Education Quality is enclosed.

A. Interpretation of results

Tabular and graphical representation of the average number of points on the final exam is given in Table 1 and Chart 1, where you can see the average number of points from the Serbian and Mathematics and the total average number of points achieved on the exam.

TABLE 1. AVERAGE NUMBER OF POINTS IN THE FINAL EXAM

School year	Serbian language	Mathematics	Total
2010/2011	11.87	11.60	23.47
2011/2012	12.05	8.91	20.96
2012/2013	10.18	9.42	19.60
2013/2014	6.11	7.56	13.67
2014/2015	11.40	6.98	18.38
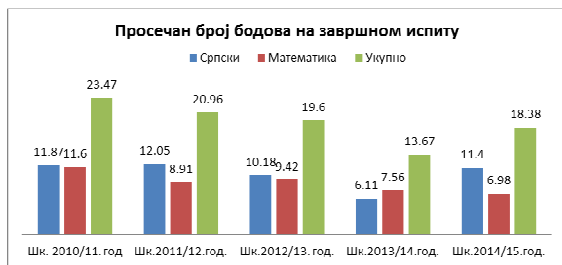
Figure 1.   Average number of points in the final exam

In Table 1 and Chart 1, we can see the average number of points on the final exam for five years back. The results show that the highest average score of 12.5 achieved Serbian language school year 2011/12 year, and the lowest average number of 6.11 points school 2014/15 year.

The highest average score in Mathematics was achieved 11.60 in 2010/11 year, and the lowest average number of 6.98 points in school 2014/15 year.

In Table 1 and Chart 1 it can be seen that the total number of points of each school year varies depending on the school year.

• Levels of achievement with the final exam for the course Serbian language

Tabular and graphical display of the level of achievement for the Serbian language in the final exam is given in Table 2 and Chart 2 where you can see the achieved level of achievement that is displayed in percentage.

TABLE 2. ACHIEVEMENT LEVELS ON FINAL EXAM – SERBIAN LANGUAGE

School year	Serbian language	Intermediate	Average level	Advanced level
2010/2011	40.80%	15.4%	40.40%	3.8%
2011/2012	24.2%	25.8%	45.6%	4.4%
2012/2013	23%	38%	25%	15%
2013/2014	37%	20%	30%	13%
2014/2015	33.2%	28%	27.4%	11.4%
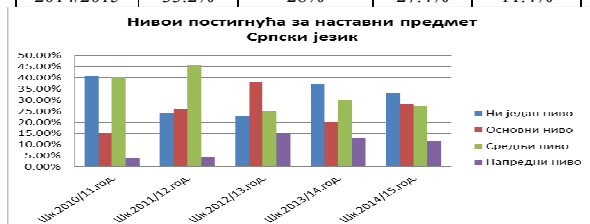
Figure 2.   Average number of points in the final exam – Serbian language

In Table 2 and Chart 2 we can see the levels of achievements in Serbian language on the final exam for the last five years expressed in percentage.

In 2010/11 the most pupils who did not achieve a single level of 40.8%, while in the school year 2012/13 the smallest percentage of 23%.

The basic level of achievement was mostly achieved in the school year 2012/13 and at least 38% of the school year 2010/11(15.4%).

The middle level is the most accomplished in school year 2011/12. 45.5% vol. while the lowest was achieved in 2012/13 school year (25%).

As for the advanced level results vary depending on the school year 2012/13. The most pupils achieve an advanced level of 15%, while in the first year final exam that number was the smallest (3.8%).

As seen pupil achievement on the final exam for the course Serbian language varies depending on the school year.

• Levels of achievement with the final exam for the course Mathematics

Tabular and graphical display of the level of achievement for the Mathematics in the final exam is given in Table 3 and Chart 3 where you can see the achieved level of achievement that is displayed in percentage.

TABLE 3. ACHIEVEMENT LEVELS ON FINAL EXAM – MATHEMATICS

School year	Serbian language	Intermediate	Average level	Advanced level
2010/2011	2%	76.8%	17.40%	3.8%
2011/2012	25.8%	46.9%	25.8%	1.5%
2012/2013	28%	35%	28%	10%
2013/2014	50%	17%	29%	4%
2014/2015	51.2%	19.2%	26.2%	3.4%

Figure 3.   Average number of points in the final exam - Mathematics

In Table 3 and Chart 3 we can see levels of achievement in Mathematics on the final exam for the last five years expressed in percentage.

In school year 2014/15 the most pupils who did not achieve a single level of 51.2%, while the school year 2010/11 the smallest percentage of 2%.

The basic level of achievement was mostly achieved in 2010/11 school year (76%) and at least 2013/14 17% of the school year.

The middle level is the most accomplished school. 2013/14. god. While 29% achieved at least a 2010/11 school year was 17%.

As for the advanced level results vary depending on the school year 2012/13 the most advanced level

pupils achieved 10% while in the school year 2011/12. This percentage was the smallest and only 1.5%.

As can be seen in published research of total pupil achievement on the final exam varies depending on the school year.

IV. CONCLUSION

In this study, the hypothesis is proven: Total pupil achievement in the final examination in primary school varies depending on the school year.

Final exam in basic education and education is taken by all pupils who successfully completed with positive eighth grade. Finish the exam is gradually changing in scope and structure until 2014 year when it was first implemented in full scale. Changes related to an increase in the number of objects that are placed on the number of unfamiliar problems in tests. Gradual transition to avoid surprises related to the content and manner of examination which reduces obscurity and the traumatic exams.

The results of the final exam are used as relevant information for the advancement of education in elementary school. Besides evaluative functions, the final exam has and the selection function. This means that pupils upon completion of the exam receive a certificate of completion of primary school and the results of final exam affect the selection of pupils for enrollment in secondary schools.

The learning outcomes at the end of primary school the focus is on the achievement of standards of achievement for the appropriate subject. This means that determining whether and to what extent achieved the expected learning outcomes around which there is consensus at the national level.

Final exam in basic education and education is the first final exam with whom the pupil meets during his schooling. He was taken at the end of the eighth grade and has the function of testimony on the adoption of basic knowledge, skills and competencies during primary education.

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Collaboration in Accessing Knowledge Content at Higher Educational Institutions

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Abstract: The use of information and communication technologies enabled the use of collaboration in accessing the knowledge contents at higher education institutions with a higher quality and in a more elegant way. This paper illustrates existing solutions in computer-supported collaboration approach in all the aspects of communication and collaboration which are supported by the electronic communication. The goal is to test the functionality of information and communication technologies of the internet services domain when they are used to communicate and collaborate, and to compare results obtained by standard (classic) techniques of collaboration with the new techniques which include the internet usage.

I. Possibilities of Communication and Collaboration Through E-Learning

E-learning is referred to as a systematic usage of web information and communication technologies to teach or study. Unique and key attributes of these technologies are [5]:

- flexibility gained through the web information and communication technologies
- electronic access to various multimedia
- potentials of the e-learning enabled by the online technologies

Flexibility of e-learning – flexible access to information and resources is the key attribute of the web information and communication technologies. The center of the flexible access concept is grading the user's characteristics. The goal is to adjust the content which is being accessed and its adopting process to the needs of the actual users, not professors and/or educational organization.

Flexible access to the content and learning resources through the web information and communication technologies in conventional classrooms, reading rooms and communities is a defining characteristic of what is known as distributed learning [3].

In such a context, different forms of computer conference technologies can be used as a support for collaborative queries of students which are not only located in different places, but also in many cases are present at different times [4].

Range of online technologies of learning allows students and teachers to engage in synchronous, as well as asynchronous interaction through space and time [6]. With these technologies at hand and with the tele-mentors available, students from different locations can also create, share and master the knowledge content and actual worldwide problems [4].

Electronic access to resources based on hypermedia and multimedia – web information and technologies of communication make the distribution of the subject's content possible in various media formats which are not usable within space-and-time limited educational situations, such as classrooms or printed editions [2]. This means that applicants in distributed educational circumstances can access various educational sources in a form suitable for their individual learning approach, in a time and place they find appropriate [9].

Educational sources can include different combinations of display, [5]:

- hyperlinked text material, incorporated pictures, charts and animations
- video elaboration of a subject, including interview and panel discussion
- hyperlinked multimedia elements like Quick Time Video, simulations, charts and animations
- "Just in time" approaches to training and assisting through tele-mentors, access to different e-communities etc.

Education software is one of the possible resources for e learning. The software in the educational field represents the intellectual technology and it is called the educational computer software (ORS - abbreviation in Serbian for *educational computer software*, ES for *educational*

software), which needs program languages and tools and a specific organization in teaching and learning, which are based on logic and pedagogy [8].

Designing the educational software is an enormous challenge. The ES of a good quality relies on a relationship between a user and the computer. It is very important to include users in designing process of ES, because they do not hesitate to show their feelings or thoughts [7].

Potentials of e-learning through online technologies – Researches of studying and teaching suggest that human beings learn most effectively by accomplishing realistic goals which are also the essential motive [14].

Learning is significantly increased when it's based on solid grounds and placed in an authentic context of a solution of the problem [2].

Everyday classroom curriculum, although easily being cost-effective, is greatly limited by the fixed time-line and space, and to the certain amount, limits the studying in the context of reality.

The main goal of this approach is to create the common learning environment which enables the supported research by the users and the professors, which enables them to understand both the type of the problems encountered by the experts in the different fields, and the knowledge used as the problem-solving tool by them. As a result, the combination of the theoretical frame and different skills enable the realization of the applied knowledge concept.

For the user, the projecting of the theoretical determinants into the concrete examples in practice is of the utmost importance, so as to recognize the learning results of the certain topic content, when the real environment is simulated. If the "testing" of the obtained theoretical knowledge is enabled for the user through the collaboration and during the learning process itself by problem solving which correspond the topic content in reality , the defined learning goals are that much more expected to be reached.

The experts are known to be acknowledged with the endemic nature of their disciplines. That being said, the constant access to the numerous resources and experiences, including the simulation of the circumstances which are not easy to be grasped in real time, is necessary. The on-line educational technologies are the ones which have the ability of preserving and distributing these types of learning materials [5].

II. CONTEMPORARY TRENDS

The use of the term e-learning is rapidly increasing, excluding the classical, printed material based, open and distant learning. It can be proved that the appearance of the e-learning is directly connected with the development and access to the information and infrastructure of the communication technologies. Without the access of the information and communication technologies to the infrastructure, the ability of the educational activities to survive in the e-environment is endangered.

Aside the accessibility of the information and communication technologies, the computer literacy is also important when considering the implementation of the e-learning. The educational institutions often consider that supplying the computer and internet centre with the no charge access for their students, ensures the full accessibility to the on-line topics contents and communication, especially for those who lack access from home.

This logic is threatened by the fact that the students who start to use information and communication technologies in the later stages (considering the beginning of their studies); do not possess the adequate level of abilities and skills to use the on-line technologies.

If the students are mostly the *dialup* users, the "requirements" of the content distributed on-line, are to be considered. Due to this, the contemporary practice of e-learning, as the first stage of this concept implementation, includes the research of the use of the information and communication technologies, by the student.

The main reasons why the educational institutions invest in e-learning [5]:

- The increase of the accessibility, as well as the cost cut of the information and communication technologies;

- The ICT capacity supports and enriches the classical educational practices through learning based upon the resources and synchronized and desynchronized communication;

- The ability of communication and collaboration with more people than it would be possible within a classroom;

- The need for the flexible access to distant learning possibilities, such as the home, workplace and a conventional educational institutions;

- The demand of the isolated and independent users for the alternative access and educational services;
- The belief of many educational institutions that the applying of the information and communication technologies enable the increase of the share on the growing competitive education market;
- The need amongst the educational institutions to be recognized as the up-to-date ones (with the integration of the ICT) so as to attract the attention of the parents, users…
- The belief and the expectance that the on-line learning will cut costs and increase the productivity and efficiency of the educational institution.

The main obstacles for the use of the e-learning within the educational institutions, [5]:

- Motivating the teachers to integrate the ICT in their curricula;
- The user response question;
- The problem of the financial planning of the ICT resources for the e-learning.

III. CONTEMPORARY PRACTICE

There is a wide range in the quality of various e-learning and teaching courses. A few years back, a group of experienced educators from University of British Columbia in Canada has researched Web-based courses [1]. The research was focused on the attractiveness and validation comparison of "stand alone" web-based courses. These researches define a "stand alone" course as "a course that can include bonus material, and which could be completed without face to face interaction with an instructor" ([1], p 327). They have found that only a few examined courses have offered a bundle of interactive possibilities and a chance for collaborative studying.

Many of the courses seemed to be too preoccupied with goal declarations, outcome assessments and hierarchical order of the content, as opposite to the focus on building a rich environment for learning a subject at hand. The researchers have come to a conclusion that the greater challenge for the web-based courses builders is conceptual, rather than technological. They suggest that the course creators should focus on making their courses "more attractive, approachable and more interactive" " ([1], p 348).

Furthermore, despite to the growing acknowledgement of the importance and function of the curriculum in teaching and learning, the teachers haven't been able to use all the possibilities available by the alternative technologies in learning. This is proven by the numerous websites of the university courses which contain just a bit more than a timetable, a short review of the course content, a Power Point presentation of notes made by the teacher and sometimes, an example of the exam, [5].

Instead of using the unique possibilities of the information and communication technologies, such practice gives away an "education is equal to the information flow" model, which is common for a classic classroom practice. Disregarding the abilities of the means of transmission, the nature of the subject's content and the applicants' needs, a great portion of the teaching practice continues to be led by the teacher and to be transmission oriented. The flow is rarely stopped to explain why the teaching is done in such a way and why the learning is being supported, and how the approach to the subject is based on the hard educational principles of cognizance and learning.

This type of teaching practice led to great frustrations for the applicants/students and the teachers, many of which have become rather skeptical about the advantages of the new learning technologies, such as e-learning and learning from a distance in general (Kirkwood, 2000; Rumble, 2000).

This is a classical problem of the curriculum. It is connected with the curriculum and subjects experts' failure to design such an educational and learning plan which would suit the type of subjects and the applicants/students' needs the best, whilst considering the limitations of the certain learning environments. Despite this, examples of the good teaching practice can be found. Those are the levels where the teaching experiences are carefully formed so as to support the development of the clearly determined learning results, in the aspect of the applicants/students' needs, applicants/students' competence and the nature of the educational context.

Information and communication technologies alone have a small impact on the educational and learning quality; they offer the vast possibilities to design the educational environments rich with learning resources. They are merely the "means" for the educational exchange and cannot significantly improve the teaching and learning processes by themselves. In spite of this, in the race for the acceptance of e-learning, many a teacher cannot do more than set up the course program and Power Point presentations of their lectures on the website of the course. This doesn't differ a lot from

photocopying such a material and distributing it during the class. Whilst setting up the course program and scripts of lessons on the web is a very useful use of such a technology, there is a lot more to be offered by the information and communication technologies, in the sense of the support to teaching and learning.

In order to make a complete use of possibilities offered by these technologies, the utmost attention must be paid when pedagogy of the *transaction* of learning and teaching is considered. This relates to the "plan" of the teaching and learning environment, which amongst else, includes considering how the subject is to be presented, the work that is to be done by the students, how the learning process is to be supported, how the learning is to be evaluated, and how the feedback is to be obtained, and [5].

There is no lack of advices so as to how to plan the rich e-learning environment, in order to enable the designing of the best learning technologies used (v. Burhess & Robertson, 1999; French, Hale, Johnson & Farr, 1999.). The variable needs of education and training in higher education, lead to considering the classical approaches to teaching and learning. This, amongst else, enables the teacher's role to change into the "side guide". This includes the change of the nature of learning from "teacher-guided" to "student-oriented" or "student-centered". Information and communication technologies have a significant role in the support of such announcing changes in the nature of teaching and studying.

French, Hale, Johnson & Farr (1999) suggest the three types of use of the information and communication technologies so as to support the "self-oriented" and "student-oriented" learning environment. Those are:

- *Increased teaching* based upon the premises that a teacher can increase the teaching practice by supporting it with one or more aspects of the activity based upon the information and communication technologies. Enlarged classrooms can use it all, starting from Web so as to distribute information about the courses, till the e-mail communication for discussion between the applicants/students and the teachers and among the applicants/students, and collaboration among the applicants/students using the computers;

- *Virtual learning* applies to the teaching and learning processes using internet, without any personal contact among the students. In this way the internet replaces the standard lectures, creating the new possibilities for the "self-oriented" and more flexible learning;

- *Progressive appliance* is related to the process of information and communication technology appliance, based upon the progressive teaching and learning technology, as the applicants/students' confidence is being developed when the use of technology and its advantages is considered. The concept of the progressive appliance of technology is based upon the "right-on-time" term of learning, which represents the process of the education approach possibilities at the time when the applicant/student wants to learn something.

IV.   COLLABORATIVE ENVIRONMENTS

Collaboration is a structured, repetitive process in which two or more people work together to achieve a common goal – in most cases intellectual labor of creative nature – by knowledge sharing, learning and achieving consensus. Collaboration does not demand leadership, and can even yield better results through decentralization and egalitarianism.

Collaboration methods of a certain structure encourage the introspection of behavior and communication. These methods have a specific goal to increase the success rate of teams involved in a collaborative problem solving. Forms, columns, tables and charts are useful in these situations to objectively document personal attributes with the purpose to argument the achievement in current and future projects.

Fast-paced changes of contemporary society and communication networks have brought changes in the level of decision making. At the same time, the complexity of the world as we know it demands a high level of specialization of the people who are making the decisions. Because of that, there is a need to create teams of specialists which carry out the complex tasks. From that aspect, the information and communication technologies play a key role when the simplicity of collaboration between the groups and individuals is being considered. E-mail, fax, Voice mail, audio and video-conferences, chat-rooms, common documents and virtual work places can enable successful collaborations [5].

Tools most often used for collaboration are divided into fields, and are given in the form of a table. Those are:

- Collaborative environments
- Collaborative tools
- On-line digital boards for the collaborative work

V. THE RESEARCH

The web sites of all the state-owned and representative private-owned Faculties in the Republic of Serbia have been included in the research. The data gathering in the research was realized by the non-standardized research of the web sites of the higher education institutions. The obtained data were processed by using the statistical methods. The presented sample is in the category of the intended ones.

The sites of the state-owned Belgrade University, the University of Novi Sad, the University of Kragujevac, the University of Nis and the University of Pristina were included in the research, which made the total of 80 universities. Beside the state-owned, the research has also covered the following private-owned universities:

the Educons University of Sremska Kamenica, the International University of Novi Pazar, the Megatrend University, the Singedunum University, the Pan European University Apeiron in Belgrade, the Alfa University of Belgrade, the Union University, and the Metropolitan University, which made the total of the 62 universities.

While visiting the sites of the universities mentioned above, the search through the student's forums and discussion groups was done also, so as to obtain the more detailed information which is not immediately available on the official sites of the certain universities. This research had a special focus on the presence of the e-learning portals, Web mails, and the use of the Forum by the students. (Eleven Erika, 2011) The research has made the following data available, presented in the Table 1:

TABLE I. THE SUMMARY RESEARCH RESULTS

The presence of the services / The university type	Web mail	Forum	e-learning portal
THE STATE-OWNED UNIVERSITY	52	4	15
THE PRIVATE-OWNED UNIVERSITY	53	19	31
Not present	37	119	96

Based on the analysis, the statistical processing and the data comparison, the following outcomes have been found.

A. The Comparison of the Available Web Mails on the State-Owned And Private-Owned Universities in Serbia

Webmail is an internet application which enables the access to the e-mail box, and doesn't require installation or feature adjustment, such as seen at traditional e-mail clients (Outlook, Outlook Express, Thunderbird etc.). All of the functions enabled by the classical e-mail client, are also available when Webmail is used-sending, receiving and reading the messages with attachments, contacts saving in the address book, adding the signature to the out coming messages, the print out of the e-mail, etc.

The messages read by using the Webmail remain saved in the box until deleted or downloaded onto the computer by the e-mail client. E-mail messages are available at any time and any place, accessible from any on-line computer. The e-mail can be received or sent from home, from your friend's place, cyber café, while traveling, etc.
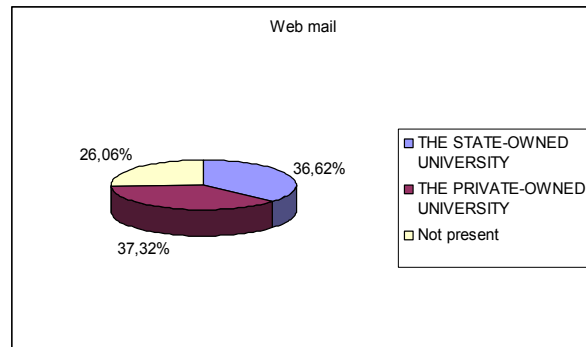
Chart 1. The presentation of the use of the Web mail

Based on this chart, it can be concluded that this service is mostly used at the *PRIVATE-OWNED UNIVERSITIES*, with 37.32%, (on the 53 faculties), while its use at the *STATE-OWNED UNIVERSITIES* comes up to the 36.62% (on the 52 faculties). 26.06% of the universities do not use this service.

B. The Comparison Of The Available Students' Forums On The State-Owned And Private-Owned Universities In Serbia

The chart 2 shows the availability of the students' forums
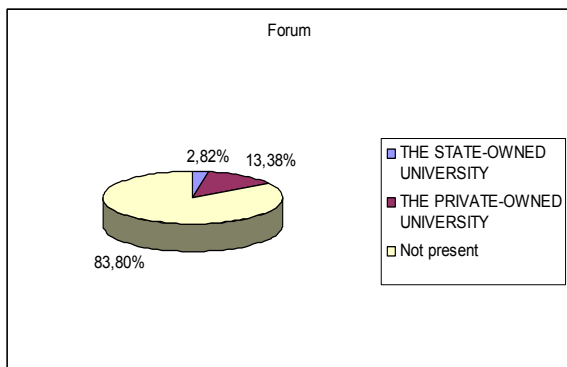
Chart 2.   The presentation of the comparison of the availability of the students' forums

Based on the chart it can be concluded that this service is more used at the *PRIVATE-OWNED UNIVERSITIES*, with 13.38% (on the 19 faculties), whilst on the *STATE-OWNED UNIVERSITIES*, it's use comes up to only 2.82% (at only 4 faculties). On the 83.8% of the universities, this service is not being used.

With the growing influence of the use of the social networks, the interest for the use of this service fades. It can be concluded by visiting the certain forums which exist, but are not used by the students and include many obsolete topics.

C. The comparison of the presence of the e-learning portals on the state-owned and private-owned universities in Serbia

This service is more used at the PRIVATE-OWNED UNIVERSITIES with 21.83%, which makes 31 faculties, while at the STATE-OWNED UNIVERSITIES it comes up to the 10.56% (15 faculties). At the 67.61% of the faculties, this type of communication and collaboration is not present.
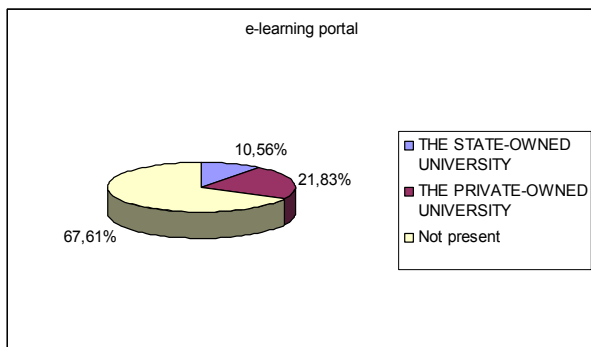
Chart 3.   The presentation of the comparison of the presence of the e-learning portals

VI.   CONCLUSION

The electronic communication makes the material available instantly; the great quantities of the material are not being printed which saves paper, as well as the delivery costs.

Because of the power to illustrate many educational concepts, multimedia contents are being integrated into e-learning, more and more. Pictures, charts, audio, video, animations and simulations are being included in academic e-learning, as well as in the corporate training. The examples include diagrams which illustrate some processes. Some applicants need to see and hear an experiment in order to understand it, and get an idea about it.

Multimedia in e-learning can be used by applicants of any age category. Younger applicants will be drawn by learning material with enhanced sound, music and animations, because those things make learning fun. For older ones, who are use to study from their own notes, video, documentary movies, simulations and animations can help in communication and making the concepts stronger.

Educators should know how to optimize the contents, so that learning and communication material can be delivered without encumbering the applicants.

Positive aspects of using the internet in communication and collaboration, as well in e-learning are:

- Improved access to information and knowledge, updated information, abundance of referential material, easy access to documents, more time spent on learning and less on searching;
- Easiness of communication, interaction between applicants, interactivities, online discussions and forums;
- Flexibility, multiple choices, options, possibility of many things being done, expansion of possibilities and points of view, diversity;
- Increased role of applicants in learning, independence, motivation and greater interest of applicants, students;
- Ability to display visual, sound and other media;
- Increased feasibility of e-learning, anyone - anywhere can be reached;
- The pressure from colleagues to overcome the classrooms;

Collaborative and cooperative e-learning is enabled by grouping the users and allowing them to use the electronic communication and collaboration, but it should be kept in mind to form the groups from users with similar learning styles, expectations, foreknowledge etc.

The most significant advantage of the computer communication and collaboration is the fact that no one is demanded to physically be present; the one actually doesn't leave the one's computer. The users can choose their time for communication and collaboration more freely with their peers or teachers.

Instead of attending the lectures and occasionally answering the teacher's questions, the access to knowledge content is available in numerous ways – listening, watching and reading, along with completing tasks and tests. When the teacher's full support is added, it is clear how the real skills are acquired. Access to the knowledge content is conducted from home or work, in real time over the internet, working with the teachers and colleagues is more active by asking questions, chatting, having the discussions on forums made for applicants, teachers and consultants, giving ideas, examples, advices etc.

The outcome of the research results is that the internet was being used the most by persons with higher education diploma, and the least by persons with less than secondary school diploma, which adds additional weight to the conclusion about the significance of communication and collaboration available on faculty websites of the Serbian Universities.

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Ranking of School Absenteeism's Factors

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Abstract – Absence from school is a time, from the traditional form of individual behavior, the pupils with cauton and very selectively used, it has become relatively widespread pattern of behavior among students who have been accepted as „normal" and used without signifikant consequences.

I. INTRODUCTION

Every pupil's main obligation is regular school attendance. It is a parental legal obligation during the elementary schooling, while it's a matter of pupils and their parent's interst in further education. The teachers consider that problem on every their meeting trying to find the way the observe pupil's reasons, causes and such a big amount of absences from school with all the consequences in a more objective and more righteous way. However, the school experience shows that the problem olf a big amount of absences from school is so hard to be solved both because of so many factors which cause the absence and also because there is still no clear and objective criteria for justifying absences.

Recently, pupil's absenteeism from school has become widespread and it indicates not only the changes in a relation between the pupils and school, but also the changes in the society's attitude towards school and education.

The absenteeism from school, as a form of behavior at school, occurs in two forms: justified and unjustified absences. The justified absences are those absences when a pupil is absent from school because of some medical reasons or sometimes because of some family reasons. The unjustified absences are those absences when a pupil avoids classes because of many reasons: boring lessons, too many obligation, fear of school tests...All those reasons cause skipping classes at school which is unacceptable. The research results show that both unsucceptable pupils and successful ones avoid classes from the same reasons and that absenteeism from school because of the school marks isn't the caracteristic only for bad pupils. (According to Milanović – Nahod, Spasenović, 2002).

The pupil is the one who decides to avoid some classes at a certain moment, because of some his own reasons, and therefore he takes the certain consequences later. It is a very important to hear the pupil's opinion about the real causes of the absenteeism and also to hear their suggestions for absence's reducing.

II. SCHOOL ABSENTEEISM'S FACTORS

A. Factors related to the pupil's characteristics

The research results on the influence of pupil's nature on absenteeism from school are pretty inconsistent. Toli (1980.) showed in is research of absenteeism from high school that among the characteristics there was no difference at the total number of absences. Sabljić (2000.) got the similar result, she determined that there was no big difference between the schoolgirls and schoolboys in the number of the total justified and unjustified absences. Unlike tham, Smyth (1999.) showed that the schoolgirls were less absent from school than schoolboys. In their research Ryan and Sur. (1998.) found the connection between the absenteeism from school at one side, and the selfrespect, selfconcept and anxiety on the other side. Thereby, the pupils who are more absent from school have a worse academical selfconcept, a lower selfrespect, and they are more prone to anxious and neurotic forms of behavior. Besides that, such pupils are often socially isolated and dumped by their classmate. The school success is a common variable in the school researches. The school success usually includes the facts that the pupils have permanently adopted curriculum, certain knowledge, skills and habits. It also means that they have developed certain psychophysical abilities and they have formed the moral knowledge of volition and working. (Encyclopedic Dictionary of Pedagogy, 1983.) From the above mentioned definition, it is clear that the school success aren't only the school marks from 1 to 5, but that one of the school success's aspects is also regular school attendance. The researches about the school success often show that those two aspects are inter connected, which means that pupils with bad marks avoid school more at the same time.

B. Family related factors

Many authors report about the important connection between the parent's factors and the pupils success at school, but also between the parent's factors and the school absenteeism. The parents differ in their structures, social and pedagogical qualities, economic opportunities and the life organization in their family, so that's why every family will have a different effects on a pupils school success. The most common parental factors that have a connection with the school success are parental income, parent's occupations, the number of chlildren in a family, a birth order and parent's education. According to Noack (2004.), the level of parent's education in different ways:

a) By transmission of cognitive competencies

b) by providing better educational opportunities

c) by transmission of parental beliefs and attitudes about the importance of educational

More educated parents have bigger possibilities to help their child during the schooling. They place higher demands against children and they are more involved in children's educational activities and their educational process. (stevenson and Baker, 1987, Noack 2004.) This involvement and cooperation with school are very important both for the pupils school success and for the prevention of undesirable forms of behavior such as school absenteeism.

A. Cotić, A. Fulgosi and B. Lazić conducted the first more extensive study about the connection between the socio-economic status of parents and school success in our country in 1963. (According to Rećič, 2003.). The more educated parent's children have better results in school than the less educated parent's children. Speaking about the parent's education, it is necessary to amphasize that most researches about this factor usually into consideration the mother's educational level. There are more reasons for that. First of all, the most children who live only with one of the parents, live with their mother. Besides that, mother's are in most cases, more involved in child's everyday school activities than fathers. They more often contact the class-masters, yhey go to the school meetings, they help their children with different tasks, and they also talk more often with a child about different school problems.

C. Family related factors

The fact that a big number of pupils avoid school points to some school factors which caused or deepened that pupil's negative attitude towards school and studyng. There are many factors that have some effects on increasing the number of absences such as tiredness and boredom at school, which are the consequences of monotonous and unattractive teaching, but also they are the consequences of the unmotivated teacher and also of the pupils overloading. The pupils that regularly do their homework don't very often sleep enough and they don't have enough free time. The tiredness makes the impossibility to solve tha tasks on time. In both cases, the pupil"s solution is absenteeism from school. If a child avoids some classes, he straggles of material at school, so it makes him avoid the next classes because he is afraid of getting bad marks. Ryan and Sur. (1998.) determined two kinds of factors related to school which causes school avoiding. The first factor is aout the pupil's perception of school's characteristick and the other one is about the pupil's perception of teachers. In fact, if the pupil sees his school as boring and unsupportive of his interests, and if the pupil considers his relationshop with his teachers as a conflict and tension, there will be a big possibility that he will decide to avoid school very often. Besides that, the relations within tha class have got a very important role in school absenteeism. If the pupil feels that his classmater accept him, and that they are friendly and cooperative to him, the pupil will so rarely avoid school. Considering the absenteeism of secondary school pupils, we should keep in mind the specific growing – up period of pupils-the period of adolescence. It is a specific period between the childhood and the adulthood which can frustrate them psychologically and which can have an effect on their behavior. At one side, they want to be like adults, they want some freedom, power, competency. Their need to form their personal idntity, their values and attitudes, their indipendence is stronger and stronger.

D. The role of the familyin solving the problem of absenteeism from school

Family is the basic social environment in which one person develops. At the same time it is the basic cell of a complex social mechanism and others who he lives or he will live with. Of course, family is the most important factor in the development and education of personality. There are several reasons for such a claim:

A child gets his first social experiences in his family and the members of his family are the first role models for a child.

- Family has an effects on a bad emotional adjustment and emotional instability of a child.

- Social behavior: good relarionships in a family enable a child to be accepted by his

peers. Bad family relationship cause the peers. The children who have good family relationships are successful at school. The children who are less successful at shool usually come from families where a great disagreement exists between the children and parents.

- The childs independence: if the relationship are good, a child is more independent in everything he does, according to (Krstić, 2009.).

Every family will have a different effect on a pupil's success at school because the families differ in their structure, social and pedagogic qualities, the economic possibilities and the life's organization in the family. The most common family factors which are connected to a pupil's success at school are: the family income, the parent's occupations, the number of children in a family, the parent's education. More educated parents have bigger possibilities to help their child during the schooling. They place higher demands against children and they are more involved in children's educational activities and their educational process. The involvement and cooperation with school are very important both for the pupil's success and for the prevention of undesirable behaviors such as absenteeism from school. Most children, who live only with one of the parent's, live with their mother. Mothers are more involved in child's every day school activities than fathers in most cases. They often contact the teachers, go to the school meetings, help their child with different tasks and they more often talk to a child about different school problems.

E. The role of the techers in solving the problem of absenteeism from school

A teacher is a person who is qualified for pupils, youth and adults education. The teacher achieves social goals and educational tasks giving some theoretical and practical knowledges to his pupils, forming a positive attitude with them, developing their personality and social activity. He tries to achieve certain results in studyng and working but also to develop and encourage numerous positive characteristics and forms of behaviour with his pupils. A person who is running for the teacher's position should be competent to do the teacher's role in professional, social and psycological terms. A teacher's obligation is to teach his pupils, to organize the classes which will enable pupils to acquire certain knowledges and skills, to monitor pupil's work and achievements, to give and provide the feedback to his pupils. It is a teacher's right to require his pupils to attend classes regularly, to participate in educational school activities, to listen

to the lectures and to do their homework regularly. As a person, teacher should be motivated to work professionally, conscientiously, and he should take care of pupils and school's interests. He should also be a role model of accuracy, responsibility and good behaviour to his pupils. He should work flexibly, which means that he should always find the best solution for every situation which would be in accordance with professional standars and pedagogical ethics, according to (Havelka, 2000.). The most common ways which are used by teachers to inform parents about the school tryancy's problem and the most common ways which are used by teacher as a school representative to cooperate with parents are: individual contacts, school meetings with parents and school meetings with parents and pupils at the same time.

Parental meeting are form of communication between the parents and the class-master. The class-master informs the parents about the pupil's work. He also gives his opinion about the pupils. He informs the parents about the conclusions of the teachers council and other organs of a school management.

The parents, whose children are often absent from school without a valid reason or have bad behavior, often avoid parental meetings or don't attend them. A teacher must be skilled and professional giving the information about the pupils. He mustn't make the parents feel embarassed because the parental meetings should be the place where the parents and teachers consult about the children's education. First of all, a teacher must have a good communication with his pupils if he wants to avoid the problem of absenteeism from school, The aducational process at school is a direct communication between the teacher and his pupils. Through this communication between the teacher and his pupils, they all realize their main roles. Those roles are very important and the successful communication between the teacher and his pupils is a condition of achieving those educational tasks. A good communication between the teacher and his pupil means a mutual respect and confidence which is a condition of a good communication. It also means honesty and sincerity between the teacher and his pupils, according to (Knežević, 2007.).

If a teacher is responsible and conscientious in his work and if he respects the school rules, his pupils will behave in the same way, thez will try to look up to their teacher, they will respect him and they will appreciate him as a person.

However, if the teacher doesn't do what he advises his pupils to and if he isn't consistent in his acts, he will lose his pupils confidence and he won't

be able to make a good communication with them and finally, his work with children will be taken under consideration.

III.   CONCLUSION

The absenteeism from school becomes a form of behavior, life and studyng. It becomes an experience which becomes stronger, more frequent and more acceptable. This researc's goal was to observe and analyze this phenomenon in order to find its real causes. Pupils absenteeism from school is a more frequent problem, and sometimes it also gives cause for concern. There are many absences from school-both justified or unjustified. Parent should take care that theur children attend school regularly. It's very important that the teacher reacts on time on every pupil's truancy from school.

He should find out the reasons of absenteeism and he should cooperate with parents and other associates in order to help pupils to go over all the problems which caused the truancy.

Pupils usually avoid school because of the fear of school tests or bad marks, or because of too many different school obligations.

If the teacher increases the quality of his classes and makes them more interesting, if he reduces the amount of school material and the frequency of tests, the number of absences will be reduces, too.

We can conclude that some changes in the whole educational system such as the rationalization and modernization   of   the   studyng   process, individualization   of   teaching,   more   quality commuication between pupils and teachers are necessary. In that way the pupils wouldn't be under such a big pressure as they are nowadays, which will also reduce the absenteeism from school.

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Factors Improving Teaching
in Technical and IT Education

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Abstract - Intensive development of technical sciences, computer science and technology and application of information technology increases the importance and interest in technical and IT education and is now one of the most important components of general education. The willingness of the school to leave the traditional educational paradigm and let the students' responsibility for their own learning is still insufficient. For teaching, as an organized process of educational work, students' motivation to learn is one of the conditions of its performance. The teacher in the education process occurs as the main holder of quality teaching with a commitment to successfully perform the tasks set before him. In addition to innovation, creativity, ability to solve problems and develop critical thinking, as well as the need to set aside digital literacy, which is to a lesser extent, computer literacy and to a greater extent the skill to use new technologies to develop their own potential. Modern devices and equipment in educational institutions are the result of rapid technical and technological development.

I. INTRODUCTION

Changes in the education systems of the 21st century, are reflected in the transition from traditional to modern education that adapts to the needs of the knowledge society and changing role of the teacher, of the transmission and interpretation of knowledge becomes a mentor and guide students through a variety of methods and techniques for successful learning and proper methods, scientific and creative ways of thinking.

Modern teaching aids nowadays are widely used in teaching and learning. Teaching subjects Technical and Information Education (TIO) weather changed and adapted to the modern concept of acquiring knowledge and developing skills in students, due to technological advancement and innovation. [1]

II. FACTORS TEACHING

Successful teaching the technical and IT education depends on several factors.

The most important factors are:

- Characteristics and quality of teachers

- The participants (listeners)

- Organization of teaching

- The material conditions of teaching (equipment of schools)

Each of these has a corresponding character factor, though all will total the desired success. The significance of these factors is not the same in teaching different subjects. In science teaching, primarily in teaching technical and IT education has decisive influence financial and organizational factors.

Since the teacher appears as the main carrier and organizer of lectures (teaching content processing) and exercises (completing work and practical assignments), he must successfully perform the tasks set before him.

It was believed that the main factors of teaching: teachers, students and facilities where they realize the projected goals, so called didactic triangle (Figure 1). In modern didactics, didactic triangle expands the didactic rectangle (Figure 2).
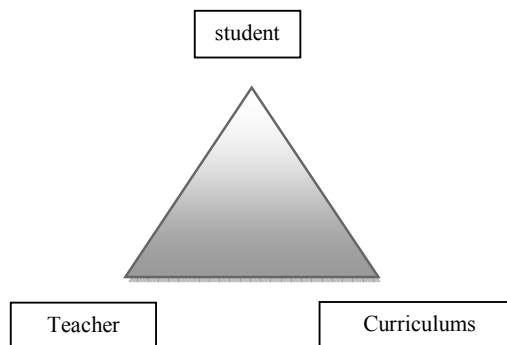
Figure 1. The didactic triangle

The student as the subject of teaching, learning objective, learning content, the teacher as the

organizer of the teaching process and methods of teaching and learning make up the most important factors rectangle didactic teaching.
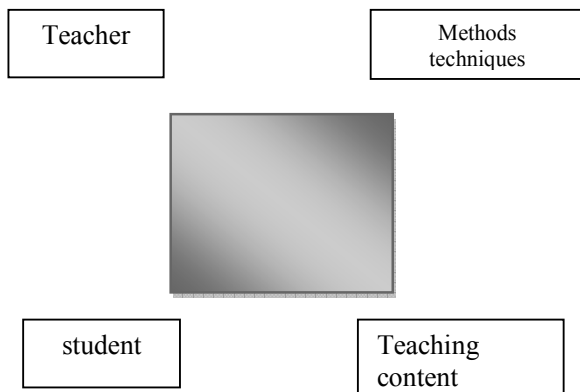
Figure 2. Didactic quadrilateral

The triangle is extended by the addition to the didactic teaching techniques rectangle. Today, the most widely represented Pratt's general model of teaching (Figure 3.).
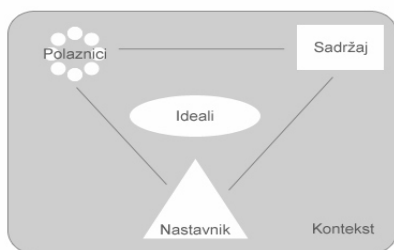
Figure 3. Pratt's model of teaching

A teacher affects the students because teaching plans and defined learning objectives, content and didactic forms the students raises the requirements in accordance with his, her abilities, needs and interests.

III.   A TEACHER IN CONTEMPORARY TEACHING

In the didactic triangle student-teacher activities, the teacher plays an important role.

He prepares and organizes the educational process and in that activity establishes a relationship with the teaching content and student.

Curriculum, determined what content should be realized in the classroom, and determined the number of hours for it. However, the teacher is not just a passive executor.

It plans and arranges the material created by the didactic and directs students to the position of the subject in the classroom. "In contemporary teaching the teacher is the one person whose role is not only to teach, but more to organize, facilitate, cooperate,

advice. He accepts the positive impacts students' (Vilotijević, 2000:153), [3]

The teacher is, therefore, undoubted pedagogical size with exceptional educational weight. It is a factor that controls the educational process in the cybernetic sense of the word. One of its most important tools in this is true authority, which is at the same time, a specific regulator student's behavior.

For effective learning and progress of students is of great importance role of the teacher. From his personality greatly depends on the development of a number of student characteristics and behaviors, the qualitative and quantitative aspects of learning, interpersonal relationships, the climate in the classroom.

The main strength of the classroom climate that is related to learning the emotional relationship or understanding what the teacher feels for each student, as well as the establishment of adequate communication. Studies have shown that at least one effective environment in which the communication is one-way and more efficient way of two-way communication. The most effective is when a teacher participant in the group, when it encourages two-way communication among all members of the group.

The authority of the teacher's personality remains what it is: a pedagogical mediator based on a real reputation confidence in the student's strengths, as well as highly developed personal characteristics that have a positive effect on students. If the relations are based only on the imposition of authority, it will become the cause of establishing authoritarian attitude.

IV.   ORGANIZATION OF TEACHING

Technical and IT education includes basic knowledge and developing the technical thinking skills and habits of a wide area of modern technology. It represents the creative and technical skills and management of modern technical aids and devices. Technical Education and Information Education includes the so-called. technical and computer skills, among others, include: making and reading technical drawings, sketches, calculations, knowledge and work on computers, measuring instruments with etc.

The contemporary world of the future - industrial, technological, IT, global needs people trained, ready and able to use complex new tools, quickly and efficiently adopt, build and implement a variety of knowledge, skills and abilities.

This leads us to the conclusion that the Technical and IT education in modern conditions of life and work, as a specific segment of the education system, belongs to the new, changed roles in contemporary society.

The goal of teaching technical and IT education in primary school is to ensure that all students acquire the basic linguistic, technical and computer literacy and to progress towards the realization of appropriate standards of educational achievement to be able to solve problems and tasks in new and unfamiliar situations, develop motivation learning and interest in the subject content.

The task of technical education at the school is to provide general technical education. The pedagogical task is to enable students' basic insights and experience in dealing with active agents and methods of the art. In this way, the student develops a conscious and differentiated relationship to their environment and acquire technical basis for the preparation of your choice of profession.

Five interrelated goals in the Technical Education and information describing the tasks that this case has:

- To acquire basic and necessary practical knowledge and skills for independent use of tools, materials, machinery and household environment,

- Acquisition of basic technical knowledge of topics, from the environment

- Insight into the historical and current development of technology and its impact on human life,

- Developing skills recognition of technical means and procedures, as well as their corresponding evaluation

- The method of practical work on the lessons of technical and IT education can be used alone or with another method such as the method of graphic works and demonstrative methods

V. TEACHING AND TEACHING AIDS IN TEACHING TECHNICAL AND INFORMATION EDUCATION

Teaching aids include those objects that the teacher and students use in the treatment of new teaching content, learning, practicing and checking.

Teacher 'the soul' learning resource and allows it to be utilized at the right time in the classroom. One teaching tool can be utilized in several subject areas, in more ways, in more operations. Teaching

resources with a limited number are not the most suitable for the purpose of teaching because they limit the search to discover new.

Teaching aids only make it easier for teachers and the students' work, and as such are an intermediary between teaching content (program), students and teachers. Between teachers and teaching aids must not appear a conflict, especially when one take in mind that the use of teaching aids in itself can raise the level of teaching and increase the efficiency of learning.

Interaction between the teacher, as the organizer of didactic process, and students, as a subject of instruction, can bring results that do not relate only to the knowledge and skills, but also on the formation of attitudes of students towards the didactic process in terms of developing the motivation and attitudes of students towards working together. All this favors the use of teaching aids in class.

Application of teaching aids in the modern educational teaching process depends on many factors:

- positive attitude of teachers towards innovation;

- a clear understanding of innovation;

- innovation should be in the context of teachers' skills;

- providing the necessary resources for innovation;

- administrative and organizational preparations;

- the use of communication channels for providing information;

- the time required for the acceptance of innovation and other

- audiovisual (sound instructional film, television show).

- to present the material backbone contemplative activity,

- intellectual functions.

VI. APPLICATION INNOVATION

Modern teaching aids nowadays are widely used in teaching and learning. Teaching in the subject Technical and Information Education (TIO) weather changed and adapted to the modern concept of acquiring knowledge and developing skills in students, due to technological advancement and innovation. [2]

Modern devices and equipment in educational institutions are the result of rapid technical and technological development. Nowadays, teaching aids in teaching TIO play a significant role. The aim of this paper is to highlight the importance of the application of teaching aids in the teaching process, primarily in the Technical and information education. The problem with this is whether the use of modern teaching aids can improve the teaching process.

A. The computer as a teaching tool

The computer is a new powerful teaching tool, which, along with the right accessories, software and connection to the internet, can replace many other teaching aids. It is physically impossible to provide one teacher for every student, but in modern society, we have the ability to use computers in the classroom. In this way, each student can progress in accordance with their abilities. The use of computers in education should make lessons more appealing to students which encourage active learning and higher motivation of students. [4]

Information should be interesting; lessons are more tailored to the needs, abilities, interests of students, and the pace of work of students. Program "Digital School" is implemented by the Ministry of Telecommunications and Information Society, and it is possible that all primary schools in Serbia are equipped with the latest computer equipment.

Now, not only technical and IT education, but all teaching classes can be held in the "digital classroom" .Models use of computers in education in teaching computer has multiple functions. Can replace the highest number of teaching aids (TV, VCR, overhead projector, tape).

Using a computer can be avoided short comings of traditional teaching:

- the student is not a passive receptor, object classes, but learns actively, according to their own pace on the subject of teaching.

- the student knows exactly what is in his answer right and what is wrong. Continuously receives feedback about the accuracy of their own answers, so control you.

Computer-aided simulation is a special type of teaching using computers more suitable in natural, especially technical disciplines in which there is a possibility of visualization process. The essential feature of computer simulation modeling using mathematical apparatus and / or formal logical rules. From the viewpoint of students speaking, using a computer simulation provides two-way transmission of information, because the student can independently manipulate the variables of the model.

Virtual laboratories, experimental programs created using a computer, require the integration of laboratory procedures in software solutions, but also the formulation of specific curriculum and determining how complementary educational outcomes. They use all the achievements of teaching by using computer simulations.

On-line teaching (or web-based teaching) requires the integration of students to the Internet. This allows access to different data sources, direct exchange of information, discussion, checking etc. progression. This kind of teaching draws on previous ways of using computers in the classroom. It can be a stand-alone teaching, or the possibility of adding recognizable in regular teaching activities.

B. Application of modern technologies in teaching process

In terms of modern teaching is no longer the question of whether to apply modern information technology, but the main task is to reach the appropriate solutions, as well as how to apply new technologies in the context of the subject areas. First of all, to improve the quality of teaching and learning has become more efficient.

Communications technology enables the teacher to improve their information or to better and more complete, in accordance with modern scientific achievements, preparation for teaching. On the other hand, the teacher is in a position to them and encourages students to research and learning by making them valid and well thought-out tasks directed to demand and receive adequate information to enable them to understand and interpret.

Computer Assisted Learning (CAL) student uses the computer in the learning process, which involves the use of educational software, computer simulation, virtual reality, artificial intelligence and others.

Computer Assisted Research (CAR) is used for theoretical research in various fields of literature and empirical research supported by appropriate statistical software .

Distance Learning (DL) is carried out using a computer, telecommunications and cable television.

E-learning

The term e-learning means' teaching content and learning activities realized with the help of electronic technology ". From this we can conclude that this is a very general concept that can cover the

full range of implementation of e-learning. The problem with such a general definition lies in the fact that the weather caused a number of different interpretations and synonyms of the term e-learning that today introduces considerable confusion in the understanding of what to do is. One way to classify e-learning is through the media that is delivered. In this case, there are two categories: learning based on the Web (Eng. Web based learning WBL training or WBT) and computer-based learning (Eng. Computer base CBL learning or training CBT).

VII.   CONCLUSION

Factors classes are very important for the good organization of teaching. All factors should be fully present and realized, and just so teaching can be successful. It is very important and the relationship between the factors of teaching. They are interconnected and depend on each other: students from teachers, students, teachers, and neither of them cannot be content without teaching.

The fact that we have provided material and technical requirements (equipment and space) does not mean that it will be implemented quality teaching. The holder, i.e., a factor-factor that creates high-quality teaching is the teacher, while other conditions only logistical support to quality education process.

From all this it can be concluded that the use of ICT in teaching more than necessary, because many aspects of the modern conception of education cannot be achieved without it. Within education, ICT is gaining increasing importance and its application in teaching led to the modernization of the teaching process and the increasingly popular classes known as e-learning or e-teaching.

The main objective of introducing information and communication technology in the educational process is fast, accurate and reliable acquisition of knowledge.

The teaching system is, inevitably, being adapted to changes in education arising influence of information and communication technologies in the overall primary education. Only teachers who teach their students communication competences (learning information search, learning application information etc.), can direct their students to lifelong education as the foundation of a knowledge society in which ICT and the computer has become an integral part of the draw.

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Innovations in Teaching Technical and IT Education

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Abstract - New knowledge and new technologies affect the reform and development of changes in the content, improving the techniques and technologies of teaching and learning. As such, replacing many of the basic features of contemporary society is a continuing need for improvement, innovation and training in all areas of human activity. Education is an area that also requires constant innovation through changes in educational models and the application of new, interactive teaching model, changes that are changing the way of acquiring knowledge by introducing information and communication technologies and e-learning. A critical view of the four innovative model classes: interactive teaching, programmed instruction, computer-informative classes and distance learning, whose characteristics make them particularly suitable for use in education through educational computer software.

I. INNOVATIVE LEARNING

Innovation is a necessary condition for the improvement of any activity, including educational. Modern information technology has changed the way of working in almost all areas.

Innovation in teaching means innovation in pedagogical reality. The purpose of the paper is to improve the industry in which it introduces the improvement, modernization, advancement development. Innovation is by its quality always progressive developmental changes.

Education is the area by requires constant innovation, the introduction of information and communication technologies and e-learning.

II. THE TYPES OF INNOVATION

The first category - the reform innovation can be divided into four groups: System innovation, Organizational and conceptual innovation, Software Innovation, Physical and Technological.

The second category: didactic and methodological innovations, which are: realized in pedagogical work of schools, also be classified into four main groups: Innovation in the preparation of the Pedagogical-educational work, Organizational innovation, Media Innovation, Evaluation-reference to assessment of innovation.

III. MOTIVES FOR INNOVATION

The intensive development of science, technology and technique requires that each teacher receives at a depth of knowledge of their discipline, and it requires a multidisciplinary approach in the classroom.

The development of science and technology affect the growth of the volume of scientific and social information that is directly relevant to individuals. Continuing training of teachers for the implementation of modern information technology opens up the possibility and the need for team work of teachers and students teamwork. The role of the teacher is changing, and the teacher is not only a teacher already teaching and organizer partner in direct communication. [3]

IV. PROJECT TEACHING

Lessons based on the projects appeared in the early 20th century development and application of creative abilities of teachers and their direct impact on the development of creative thinking of students (all participants in the educational process) is the main tasks of the project continue. Project teaching is the most complex form of practical and meaningful intensive acquisition of knowledge, and of integrated activities, or from the continent and the problem area of knowledge, representation, transfer and presentation, use and application specific knowledge. The requirements of this teaching the fastest and most efficient achievement of the targets, as well as elaborate criteria for evaluating the results of the ultimate goals of teaching through their materialization in solving problems. Project teaching is goal directed process of limited duration that requires certain resources and organization performance. As a rule, the project continues to be organized as a research, development or innovation that involves and requires a high level of

independent thought and practical activities for teachers and students.

The project organized teaching use object, system and procedural aspect. Scientific research and educational project processes which include project strategies are put into a single project processes whose characteristics are: target orientation, temporality, one-off (non-repeatability to the subject of the project), -limitation of the duration. [1]

V. STAGES PROJECT TEACHING

The project continues the educational process is carried out in the following stages:

- The teacher, in collaboration with students, elected topical problem for the students themselves have practical value. It is very important that the students themselves are interested in the selected problem and about him have at least some experience

- Jointly project of the problem is determined. Teacher seeks to give students as many proposals to solve, and he directs their initiative, update them and finally taking shape.

- The project is implemented in various forms of social groups, in pairs or individually in classrooms, laboratories, a library, for example field economy. Collected the necessary data that can contribute to perception and problem solving.

- For a renewal of the collected data and the analyzed information, which are brought into logical connection with each other, are performed and verified conclusions. Access and correction if required. Results are displayed in different ways: as written reports, drawings, sketches, slides, video-tapes, and the table with the necessary data.

- The final stage is the practical application of the results. This means that students should do their part, but if the task is complex and includes and some factors from the environment, then the school should be interested in them that they engage. [2]

TABLE 1: V.S.KUKUŠIN PROVIDES AN OVERVIEW OF THE ORGANIZATION tf EDUCATIONAL PROCESS IN PROJECT TEACHING THAT WE HAVE CHANGED.

Stages of teaching activity	Activity of teacher	Activity of students
1. Election and elaboration of the terms of reference		
1.1. Selection of the topic	Teacher with students, proposing topics	Students are corrected and, together with the teacher, choose a topic.
1.2.The interpretation of the theme subtopics	The teacher proposes subtopics and proposes the students to choose. The teacher and students debating the sub-topics.	Each student chooses a subtopic or proposes a new one. Students discuss and propose variants subtopics.
1.3. Forming a group creative	The teacher performs organizational unit and form groups of selected sub-themes.	Students are divided among themselves roles like the successful realization of gain (the selected task.)
1.4. Preparation of materials for research: formulating questions, tasks for the team, the choice of sources.	If the project is extensive, the teacher in advance elaborates tasks, issues of research and literature.	Students accept liability in making the assignment. The answers to these questions t can be administered exam through discussion
1.5. Determination of forms of presentation of the results of project activities.	A teacher participating in the discussion	Students in groups, then in the class discuss the forms for presenting the results of research activities: video-film album, report, spreadsheet views.
2. Elaboration of the project	He teacher guides the work of students and encourages their activity	Students explore according to pre-determined questions.
3. Tidying up results	A teacher instructs students how to arrange the results.	Students first in groups and then in the department arrange the results according to the accepted rules.
4. Presentation	The teacher organizes expert assessment (invites experts, parents and the best students) to assess the work of which the students report back.	Students report the results of their work.
5. Reflection	The teacher assesses the pedagogic impact of their work.	Students evaluate the whole process and their role and contribution to it.

Project teaching allows students to expand and enrich their experience, to master the learning style that suits them best id and become independent. The realization of tasks, at least as far as the calculation, tabulation, graphical representation is much easier if the paper uses modern information technology.

VI. CONCLUSION

Information technology is very powerful and has become one of the leading teaching technologies. Educational software is a combination of different media, in correlation with other educational materials significantly enhances the learning process. Educational computer software in teaching classes used to be better and more appropriate to the information interesting to students, lessons adapted to the needs, interests, abilities and pace of work of students in order to increase motivation and student activities. A student in the classroom assisted learning computer software is responsible for their own learning, striving for a deeper understanding of the benefits a multitude of resources, there is constant feedback, tends to higher achievements. There are many reasons for the use of educational software, which each year has a growing role in the teaching process, and is therefore very important that the features formed according to the basic didactic principles and characteristics of innovative teaching models.

Education must follow the global information processes. Improvements in information technology and the possibilities of its application in educational processes there is a need for new, more modern way of organizing the learning process for acquiring knowledge. The teacher is seen as the main driver and initiator for the modernization of education in our school system. The training of teachers is a process that refers to the constant development of knowledge, skills and abilities of new knowledge from different professional fields and scientific disciplines in the world of practice, as well as monitoring European trends in terms of improving the quality of education. He must constantly be educated and sophisticated in order to respond to the new demands placed before him by contemporary society. If digitizing all has an increasing role, then it must become a part of the culture of learning in schools, not just one that looks critically at digital media, but also the one who uses them as a tool for learning and teaching. The quality of teachers in the final extent determines the quality of teaching as the educational process.

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Self-evaluation of Work Quality Effectiveness and Efficiency for Bilingual Schools

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Abstract - The subject of this research is the examination of the employees' satisfaction in a bilingual school in the area of the quality of the teaching. A standardized questionnaire was conducted and the scale of the Ministry of Education for school self-evaluation of the quality of work. The sample (N 45) was represented by the employees in school with bilingual teaching. Self-evaluation in the field of quality has allowed the quality of the school and the teaching process itself to be regularly assesses. The research results indicate that in the framework of the evaluation of "quality assurance," the school has more strong than weak sides, but the existing weaknesses reduce the overall quality of school work. That's why we would put ourselves in the level of achievement 3. Thus, in this area of evaluation, a school shows good results in certain areas, but this area should be a priority in order to raise the quality of work in a school to the highest possible level. The research lead to the conclusion that the school board members are involved in the recording of their self-evaluation, they work on the development of their action plans, but they do not adhere completely to their action plans. We can see that school board members are not fully satisfied with the organization of work and rewarding. Members of the school board most lack in motivation for team work and the support of their colleagues. The improper allocation of tasks according to the knowledge and experience is quite a big problem in school. The guidelines for the forthcoming period refer to the improvement of the self-evaluation of employees, monitoring the efficiency and effectiveness of work, motivation for participation in activities, the introduction of a system of rewards.

I. INTRODUCTION

Establishing a system of quality is essential in all areas of operation and labor, naturally, and in education which influences the development of a society as a whole. Quality assurance is one of the basic conditions in the work of the school in a changing environment [5]. In order to be more attractive, especially today when funding is conditioned by the number of students, it is very important for schools to understand the system of quality assurance and systems that are used to verify the value of quality. The values obtained in the research cannot be neglected, but they are seen as basic information for quality improvement [4]. Self-evaluation is located in the center of the system of education quality [7]. This means that schools as institutions of professionals and experts have got an opportunity to plan their own development and to be equal partners to educational authorities in establishing, promoting and ensuring the quality. The quality of education is becoming increasingly important for those who take part in it directly or indirectly, or use its services [1]. When it comes to the quality of education it is necessary to analyze all segments of the education process [6]. Self-assessment is now often referred to as "self-evaluation", which highlights the adoption of valid and reliable conclusions about the quality, based on the evidence that are public and are referred to in the report on self-evaluation. Self-evaluation should be a cyclical process and lead to improvements or to maintain extremely high standards. The implementers are responsible people who have the task to implement the preset and determined activity in a given period of time [2]. The task of the Quality Team is to lead the school to a leading position in the provision of quality services [3].

As we have previously stated self-assessment is a procedure that evaluates its own practice and its own work. Self-evaluation is often described as:

- The key instrument for quality improvement of work

- Something that all schools should do to provide evidence for that

- The main characteristics of autonomy and responsibility of schools.

II. METHODOLOGY

A. The problem and case study

As part of the research we have dealt with the self-evaluation of functioning of schools with bilingual classes, where we have put the focus on the quality of education system. All schools with bilingual classes compile an annual report on self-evaluation, whose essence should be evaluation based on the responses received on the basis of Standard criteria of work quality of educational

institutions with additional standards of quality of schools with bilingual teaching, as well as other relevant internal and external quality models [8]. In compiling the report on self-evaluation, schools with bilingual teaching should draw conclusions on their performance and to identify strengths, weaknesses and other aspects of its educational offer in which there is a need for improvement. The subject of this research is to examine the satisfaction of employees in a bilingual school in the area of the quality of the teaching itself.

B. The objective and tasks

According to the presented object of research, we can determine the objective of the research, which is to establish the strengths and weaknesses of observed schools with bilingual classes in securing quality. The tasks of the research are based on examination of employees' satisfaction in the area of work quality assurance, which is based on self-evaluation of the efficiency and effectiveness of the work.

C. Research questions

Pursuant to the research, the following research questions can be set:

Q1: Do school board members work on their self-evaluation?

Q2: Are the school board members satisfied with the organization of work and rewarding?

D. The organization of research

In order to determine and analyze the connection between the variables, the survey was conducted in accordance with the questionnaire established by the Ministry of Education by the government of Montenegro and the Republic of Serbia "THE MANUAL FOR SELF-EVALUATION AND EVALUATION OF SCHOOLS". These survey sheets indicate how many teachers and staff, some of the things they consider important and accurate, that is, present. The study sample consisted of 40 employees working in the main building and in separate departments in Montenegrin and Albanian language and 5 members of the school board. The results are presented in the form of graphs and are expressed in percentages.

III. RESULTS AND DISCUSSION

Based on the analysis of the responses given by employees, the following data were revealed:

On the basis of the following testimony "in the school, self-evaluation is carried out on the basis of established criteria", 16 employees (40%) responded that it was "very important" and 20 (50%) that it

was "completely true". 24 employees (60%) believe that the claim is "important," a 14 of staff members (35%) opted for the answer "to a greater extent, true." "To a lesser extent is important" was not chosen by anyone, while 6 (15%) consider "accurate to a lesser degree." No one chose answers "irrelevant" and "false". Based on consideration of all responses we get to the conclusion that all employees have a positive attitude towards the quoted statement. Regarding the degree of presence in the practice-accuracy in practice, the majority of respondents believe that the school self-evaluation is conducted on the basis of established criteria.
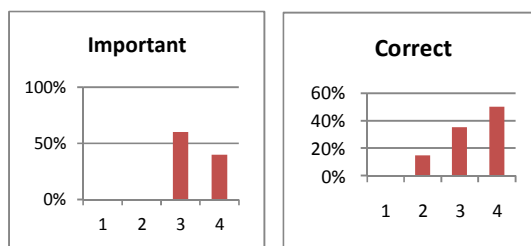
Figure 1. The following testimony: „In the school, self-evaluation is carried out on the basis of established criteria"

On the basis of the following testimony "I'm in the process of self-evaluation", 20 (50%) of respondents believe that the claim is "very important" and 20 (50%) consider it "completely correct". That it is "important" replied 20 employees (50%) and that it is "to a great extent present" was considered by 14 of them (35%). No one opted for the answer "little matter" and that it is "present to a lesser extent" was opted by 6 respondents (15%). There were no answers with "irrelevant" and "incorrect". From the obtained results we can deduce that a positive attitude dominates towards the importance of claims as well as to its accuracy-presence in practice.
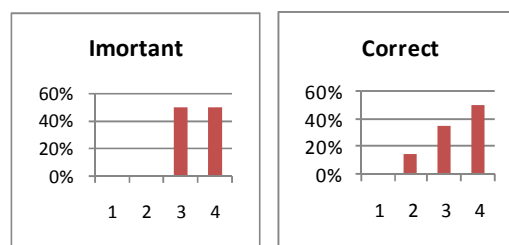
Figure 2. The following testimony: „I'm in the process of self-evaluation"

On the basis of the following statement of "I'm keeping track of my self-evaluation", 8 employees (20%) consider it as "very important", 8 (20%) that it was "entirely accurate". That statement is "important" the answer was given by 24 (60%) of

respondents, while 20 (50%) that consider it "to a great extent true". As a "little matter" were 6 (15%) answers and 6 (15%) that it is "true to a lesser extent". That is "irrelevant" consider 2 (5%), and that it is "incorrect" 6 (15%) of employees. From the obtained results it can be concluded that the majority of employees have a positive attitude towards the importance of claims. As far as the representation of such behavior, slightly more than half of the employees keep track of their self-evaluation.
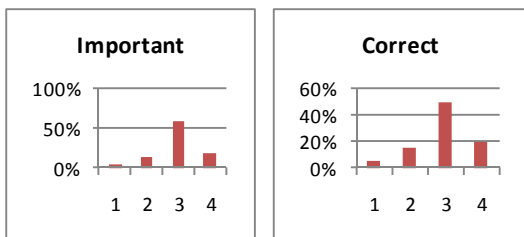
Figure 3. The following testimony**:** „I'm keeping track of my self-evaluation"

On the basis of the following statements "I create an action plan for overcoming the identified weaknesses", 8 respondents (20%) consider that it is "very important" and 20% (8 respondents) consider claim as "completely correct". 24 respondents (60%) answered that statement is "important" and 20 of them (50%) answered that it is "to a great extent correct". 4 employees (10%) consider it "little important", and "to a lesser extent present" 4 (10%). The claim is "irrelevant" to 4 employees (10%) and is "false" for 48 of them (20%). From the obtained results it can be concluded that the majority of employees have a positive attitude towards the importance of the statements. Also, slightly more than half of the respondents draw up their action plan to overcome the identified weaknesses.
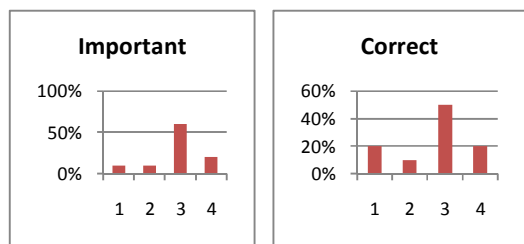
Figure 4. The following testimony**:** „I create an action plan for overcoming the identified weaknesses"

On the basis of the following testimony "I Follow the effects of the steps taken in the framework of my action plan", 20% (8 employees) responded "very important" and 10 (25%) of them gave the answer "fully present".26 (65%) of employees consider that statement is "important" and 40% (16 employees) answered that it is "to a

great extent present". 4 (10%) of the surveyed believe that it is "little important" and 12 (40%) that it is "present to a lesser extent." 2 employees (5%) think that is "irrelevant" and that it is "incorrect" 2 (5%). By analyzing and reviewing the received responses, we come to the conclusion that there is a positive attitude towards the importance of that statement and more than half of the respondents declared that they actually do that in practice.
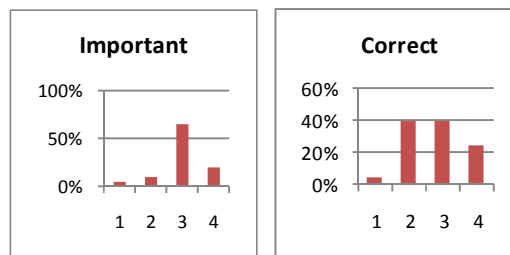
Figure 5. The following testimony**:** „I Follow the effects of the steps taken in the framework of my action plan"

Based on the following testimony: "Duties and responsibilities are allocated to employees on the basis of expertise, knowledge and skills", 26 (65%) gave the answer that it is "very important" and 14 (35%) that it is "fully present". The answer "important" was given by 10 of them (25%), and that it is "to a great extent in practice" is considered by 16 (40%) of employees. The answer "slightly important" was given by 4 respondents (10%), and 6 (15%) consider it is "to a lesser extent present." Not one employee considers that the claim is "irrelevant", 2 (5%) opted for the answer "false". Based on the answers, we can state that a positive attitude dominates towards the importance as well as to the accuracy of the statements, and that the obligations and responsibilities are allocated to employees based on their expertise, knowledge and skills.
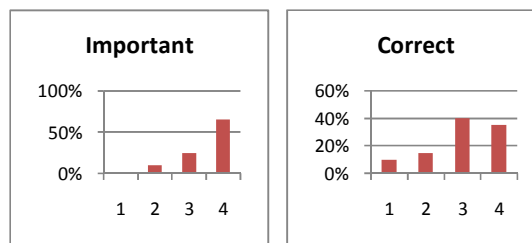
Figure 6. The following testimony**:** „Duties and responsibilities are allocated to employees on the basis of expertise, knowledge and skills"

On the basis of the following testimony: "Duties and responsibilities are clear, accurate, timely and contribute to the effectiveness of the school", 30 (75%) gave the answer it is "very important" and 14

(35%) that it is "completely correct". That statement is "important" is considered by8 (20%) employees and 18 of them (45%) believe that it is "to a great extent present." 2 employees (5%) gave the answer it is "slightly important" and that it is "to a lesser extent present" is considered by employed 8 (20%). No one opted for the answer "irrelevant" and that it is "false" is considered by 2 respondents (5%). By reviewing the obtained answers, we can conclude that a positive attitude towards the importance of such allegation dominates. As for its presence in practice is concerned, most respondents considered it accurate and have a positive attitude.
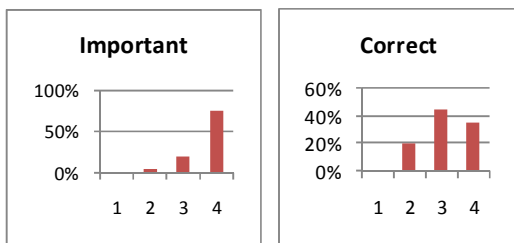
Figure 7. The following testimony**:** „Duties and responsibilities are clear, accurate, and timely and contribute to the effectiveness of the school"

On the basis of the following testimony "Teams are formed on the basis of expertise, knowledge and skills of the members", that it is "very important" is considered by 26 of them (65%), that it is "entirely true" by 12 (30%). It is "important" answer was given by 12 respondents (30%), and that it is" present to larger extent" by 10 (25%). 2 (5%) claim it is "slightly important", and for 16 (40%) it is "to a lesser extent present". Nobody answered "irrelevant", 2 (5%) believe that it is "incorrect." On the basis of answers, the conclusion is that a positive attitude towards the importance of such allegation dominates. Regarding to the representation of this situation in practice, opinions are divided. About half of the respondents believe that such a division is represented in the work of the School, in whole or greater extent, while others are of a different opinion.
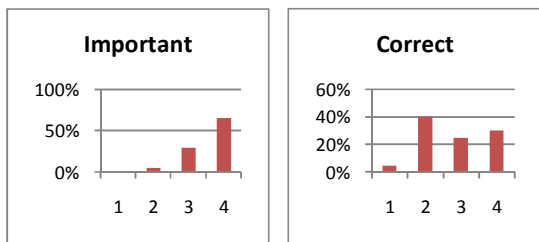
Figure 8. The following testimony**:** „Teams are formed on the basis of expertise, knowledge and skills of the members"

On the basis of the following testimony "Effectiveness and efficiency of working in a team

is motivated and stimulated", 22 respondents (55%) say it is "very important", and that it is "completely correct" was answered by 4 of them (10%). 14 employees (35%) responded "it's important", and that it is "to a great extent true" 10 (25%). That statement is "of little importance" consider 4 employees (10%) and that it is "present to a lesser extent" is considered by 12 of them (30%). No one opted for the answer "irrelevant" and 14 employees consider the claim "inaccurate". Based on the analysis of the responses we see that a positive attitude when it comes to the importance of such allegation dominates. When it comes to the accuracy-presence in practice, a negative attitude dominates. Although employees consider important that the efficiency in work get rewarded, most of them think that the reward system is not implemented or implemented on a small scale.
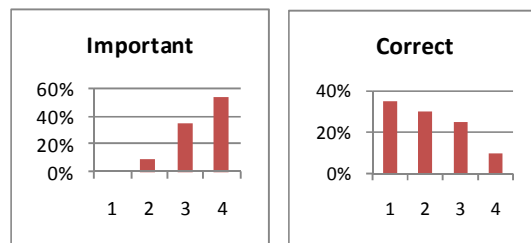
Figure 8. The following testimony**:** „Effectiveness and efficiency of working in a team is motivated and stimulated"

On the basis of the following testimony "Proper distribution of operations ensures the work efficiency of the school", 30 (75%) of respondents answered that it was "very important", and of the total, 10 of them (25%) believe that the claim is "fully present". The answer that it is "important" was given by 6 (15%), and the answer that it is "to a great extent present" by 18 employees (45%). That it is "of little matter" and "to a lesser extent present" is considered by 4 respondents (10%). No one gave the answer "irrelevant", and 8 (20%) of employees responded with "incorrect". By the analysis of the obtained results we deduce that a positive attitude towards the importance of the above mentioned claim dominates. Also, there is a positive attitude to the degree of its presence in practice.
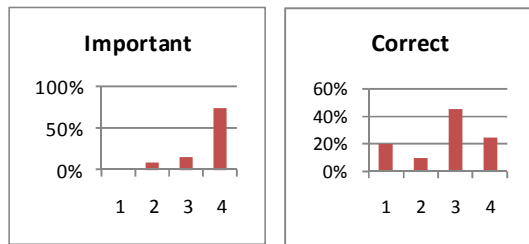
Figure 9. The following testimony: „Proper distribution of operations ensures the work efficiency of the school"

On the basis of the following testimony "The effectiveness of each employee is monitored at school", 20 respondents (50%) think it is "very important" statement, while 4 (10%) that it is "entirely accurate". That it is "important" was answered by 14 respondents (35%), and that it is "to a great extent present" is considered by 20 of them (50%). Not one employee considers that the claim is "of little importance" and "unimportant" while 14 (35%) gave the answer that it is "to a lesser extent true", and 8 (20%) believe that the claim is "false". By reviewing the responses given by employees, we can derive a conclusion on purely positive attitude towards the importance of claim, while a negative attitude dominates in terms of its accuracy and presence in practice.
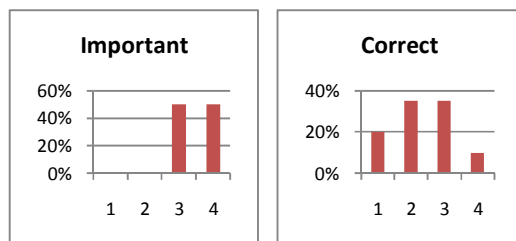
Figure 10. The following testimony: „The effectiveness of each employee is monitored at school"

On the basis of the following testimony "The school has precisely defined criteria for praising and rewarding its employees", 28 respondents (70%) believe that it is a "very important" statement, while 4 of them (10%) that it is "fully present". That it is "important" is considered by 12 employees (30%) and that it is "to a great extent true" by 8 (20%). Nobody chose the answers "slightly important" and "unimportant". That statement is "true to a lesser extent" is considered by 12 employees (30%) and 16 of them (40%) answered that it is "unimportant". By analyzing the responses given by employees, we can derive a conclusion on purely positive attitude towards the importance of such statement. As for its accuracy, a negative attitude dominates about her

presence in practice and employees believe that there are no criteria for rewarding employees.
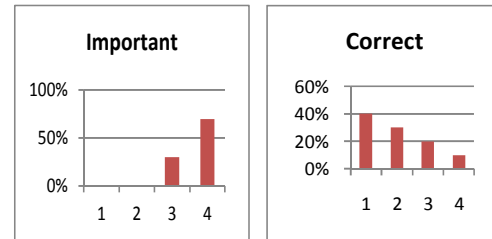
Figure 11. The following testimony: „The school has precisely defined criteria for praising and rewarding its employees"

On the basis of the following statement "Prescribed criteria for praising and rewarding are applied", 22 employees (55%) believe that it is "very important" while 6 (15%) gave the answer that it was "entirely accurate". 18 (45%) of respondents believe that the statement is "important", and 8 (20%) that it is "to a great extent true". Nobody chose the answers "slightly important" and "unimportant". That it is "true to a lesser extent," answered 8 (20%) of them and that it is "incorrect" is considered by 18 respondents (45%). Based on the answers of the surveyed workers, the conclusion is that there is a very positive attitude towards the importance of claims, but a negative attitude dominates towards its implementation in practice.
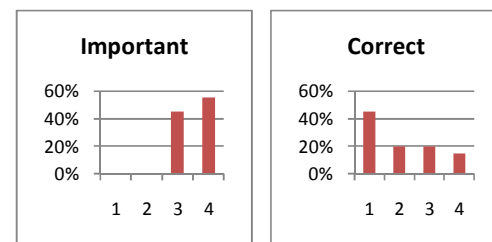
Figure 12. The following testimony: „Prescribed criteria for praising and rewarding are applied"

On the basis of the following testimony "There is a good coordination of the work of professional and other bodies at school", 20 respondents (50%) responded that it is "very important", while 10% (4 respondents) gave the answer that it is "entirely accurate". 16 employees believe that the statement is "important," and 18 of them (45%) that it is "increasingly present." 4 surveyed workers (10%) gave the answer that it is "slightly important", and 10 of them (25%) that it is "to a lesser extent present." Nobody answered it is "irrelevant", and 8 (20%) believe that it is "false". We can conclude that there is a positive attitude towards the importance of claim, but a negative attitude

dominates towards the extent of its presence in practice.
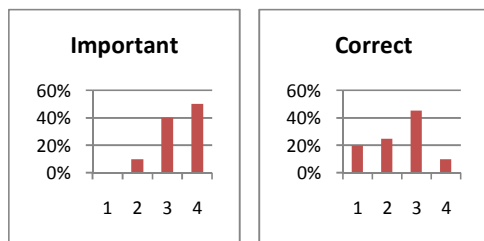
Figure 13. The following testimony: „There is a good coordination of the work of professional and other bodies at school"

On the basis of the following testimony "There is a good coordination of work between the class teachers and professional services at school" 22 respondents (55%) consider it is "very important", and 12 of them (30%) that it is "entirely accurate".18 employees (45%) believe that the claim is "important" and "to a great extent true". Nobody answered with "of little matter" or with "unimportant". 8 of them (20%) gave the answer "slightly important", and 2 employees (5%) that it is "false". By reviewing the received responses, it can be concluded that there is a purely positive attitude of employees towards the importance of the statement. Regarding the degree of its accuracy, or the presence in practice, there is a positive attitude.
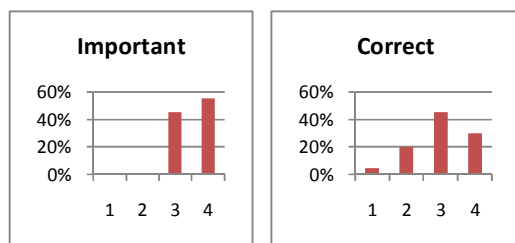
Figure 14. The following testimony: „There is a good coordination of work between the class teachers and professional services at school"

The analysis of the results obtained by self-evaluation - In primary school "Boško Strugar", the self-evaluation is carried out according to established criteria, planned and regular. All employees believe that this is important and that it is largely represented in the work of the school. Also, most of the staff considers that it important to be involved in the process of self-evaluation. Six respondents expressed that they are less involved. A potential explanation could be that during the processing of certain areas teams of a few employees are formed, so it is possible that the respondents have not been more involved in the team. The plan that exists at the School level is that for each subsequent valuation area a new team is

formed in which employees who did not participate in the previous one will be included; that will enable the contribution of each employee to the work of a particular team, and thus the School as a whole. Also, through observation and discussion it was noted that the involvement of individuals within teams is not equal. Some employees try harder and do the larger part of activity of others', so that maybe one of the reasons why some respondents declare themselves to be involved to a lesser extent. More than half of employees implement and monitor the effects of their own self-evaluation. However, most have a positive attitude to the above statements and believe that it is important to keep track of their own self-evaluation in order to draw up an action plan to address the identified weaknesses and to monitor the effects of the measures taken within the framework of their action plan. It can be concluded that more positive attitude of employees is towards the importance of given claims than to their real applicability in practice.

The efficiency and effectiveness of work - Most employees think that the duties and responsibilities are clear, accurate, and timely and that they contribute to the effectiveness of the school. Employees believe that there is a good cooperation between the work of class teachers and professional services, while the issue of coordination of expert and other organs opinion is divided. Respondents predominantly expressed that reward criteria do not exist, but everyone believes that this is very important. They also believe that teamwork is not stimulated sufficiently and that the effectiveness of individuals is not monitored. Opinions on the issue of forming teams are divided, but about half of the respondents believe that the teams are formed to a lesser extent on the basis of knowledge, expertise and skills. A possible explanation is that those individuals who want to contribute more to the work of schools are more engaged and those who put up more effort. Consequently, they are permanently assigned with tasks that others do not perform and the same staff is involved in many different activities. This School practice is a kind of weakness in the work, because a small number of employees who constantly have responsibilities become overburden and to a constant lack of motivation among others to get involved. The system for monitoring the efficiency of individuals, precise prescribed criteria for rewarding and their application, as well as encouraging and development of teamwork could eliminate this weakness and improve the work at the School level.

IV. CONCLUSION

Self-evaluation of the key area of "QUALITY ASSURANCE" has enabled to regularly assesses the quality of school work, to see what it is that has been done so far and what more can be done to get better results. In the framework of the evaluation of "QUALITY ASSURANCE" school has more strong than the weak sides, but the existing weaknesses reduce the overall quality of school work. That's why we would ourselves put in the level of achievement 3. Thus, in this area of evaluation, the school shows good results in certain areas, but this area should be a priority in order to raise the quality of work in the school to the highest possible level. In the future, efforts will be made to improve the self-evaluation of employees, monitoring the efficiency and effectiveness of work, motivation for participation in activities, the introduction of a system of rewards. To the question: "Do the school board members work on their self-evaluation?" we got the conclusion that the school board members are involved in the recording of their self-evaluation, they work on the development of their action plans, but they do not follow in full to their action plans .To the question: "Are the school board members satisfied with the organization of work and rewarding?" we got the conclusion that school board members are not fully satisfied with the organization of work and rewarding. The members of the school board lack in motivation for team work and in support for their colleagues the most. Improper allocation of tasks according to the knowledge and experience is quite a big problem in school. The poor distribution of tasks leads to a lower employee's efficiency and, consequently, a lower efficiency of keeping records of each employee, which is why the reward system is not applied fairly. A possible solution to this problem is additional training of school directors on the organization of professional services and requiring greater responsibility of each employee.

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Visual Tools as Support of Teaching

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I. INTRODUCTION

When we talk about visual tools, that are particularly great support of modern teaching, it is necessary to note what is actually teaching. There are several different definitions of teaching. Considering the faster and more frequent changes that occur none definition of teaching isn't complete and therefore it is necessary to specify several different definitions that complement each other and which actually represent a realistic impression of teaching.

Teaching is certainly one of the many aspects of education, one of the forms of international influence on personality development. In the opinion of some authors: "Teaching is a complex process that is planned and organized in such a way that students acquire knowledge, acquire skills and habits and mentally and psychologically evolve and educate versatile." [1]

In the opinion of the authors of Wikipedia teaching can be defined on this way: "Teaching was organized as the institutional and non-institutional interaction creative effort in mastering the prescribed content and the acquisition of knowledge, skills and habits but also as training for future permanent work in order to form a critical, free, autonomous, a creative, humane, educated, multicultural, multi-ethnic and multi-professional students personality open to all current and future progressive change in themselves and the society in which she lives." [2]

Accordingly all definitions we can conclude that teaching is one extremely complex and responsible process.

In fact, the process of education is one of the most important life periods. At that time, people acquire knowledge, abilities, and skills, attitudes towards work, learning and life in general.

In this period of life they acquire certain habits, whether its work habits or other habits and they are built up as person and find themselves in professional commitments which will work throughout life. Because of this period of attending educational institutions ranging from elementary school represents a period of great importance for the future life of each student. For this reason, education is a major responsibility of the organization of the teaching process in order to found a way that would allow the best and most appropriate way of transferring knowledge to students.

In the beginning the learning where the traditional role of the teacher was too dominant and role of students too passive. Learned from books that are transmitted teaching material is often caused monotony and disinterest of students. However, with the advent of modern teaching it was changed.

Modern teaching brought a high level of student participation in the learning process using computers and different teaching tools that provided the high motivation of students to acquire teaching material. Specifically, with the appearance of a large number of computer software that provided implementation of teaching in a fun and colorful way to bring the better performance teaching.

In this paper will be discuss about visual tools that have great support of teaching, introduced in order to achieve the greatest possible teaching effect.

There are a lot of computer programs that provide the teaching visualization but we will use this opportunity to talk about the most frequently used: Microsoft Power Point, Prezi and simulations and animations as form of teaching visualization.

II. SOFTWARE SOLUTIONS AS SUPPORT OF THE TEACHING VISUALIZATION

A. Microsoft Power Point

Microsoft Power Point is an application which is used to create multimedia presentations. Microsoft Company is a manufactures of Power Point. It is an integral part of the software package Microsoft Office.

Power Point is used to create multimedia presentations. Within this program it is possible to add a lot of visual and sound effects, such as pictures, sounds… [3]

Power Point software provides a visual presentation of information in an efficient format, usually in the form of automated, interactive slide – show presentation. [4]

It's presentation consisting of a desired number of single pages or slides. Within the slides can insert text, pictures, animations, sounds or other objects that are created in other programs. Combining text, tables, charts, illustrations, video and sound and recordings in the context of meaningful units come to the effective presentations. In this way, it becomes a tool to faster, easier and better transfers the idea of teaching, teaching unit and implement teaching program with a high degree of visualization. [5]

Using Power Point presentations can make a presentation of the new material make a brief restoring of learning or to check the knowledge using a variety of quizzes or tests with a lot of visual effect.

B. Prezi

Prezi presents cloud – based presentation tool for presentations, research and exchange of ideas on the Internet. All presentations that are made in this tool are working on the Internet. It is actually a tool that is the latest generation software solution that has much more opportunities for the presentation of other software solutions [6].

If you wanted to log into Prezi is necessary to possess an email address. It is necessary to go to website Prezi's there to register, enter your name, e-mail and password and of course choose whether you want to use free or pay if you want to made presentations to be private [6].

Prezi is a fun variant of the Power Point because it has more options for creating presentations. Therefore the degree of visualization that can be achieved by this program is higher than of the Power Point.

It is only necessary to have connection to the internet it would be possible to be accessed. In this way teachers were able to create a presentation with a lot of embedded images, animations, videos and other visual tools that students can open on their computers and in such a way to follow presentation from lecturers and make a lecture much more interesting.

C. Animation and Simulation

Animation

The term animation comes from the Latin. According to the definition of animation is actually procedure that creates a kind of illusion of movement on lifeless things drawings and models. Latin word from which derives the word animation means reviving or giving the soul, then animation can be characterized as giving souls lifeless things or drawing or models. [7]

Type of animation that is subject of our interest is actually computer animation. The term computer animation is considered to be the creation of moving images using a computer. On the basis of this kind of animation is enabled to make a lot of test and quizzes that may serve to fun way to check students' knowledge or how many students remembered of lecture content within the class. Even could be used for short tests of knowledge that would give immediate feedback when the answer to the question if the answer is correct or not. In such a way, students are fun but also an easier way to memorize answers if incorrectly answers the question.

Simulation

The term computer simulations mean presenting real processes through computer based on formal models (Mikelskis, 2006.). Simulation is the process of designing the real or imaginary model of a system that allows us to perform experiments. [8]

That reflected the importance of using simulation in teaching certain subjects especially in technical teaching and IT education. Based on model specific machines, tools or specific element of a computer students are able to get acquainted with some features that are not visible on the original or in the original structure so complex that with it we can't meet unless they introduce something simpler model.

They are often used to present the program content when students' receptors are not able to follow the changes in a system, device or machine. It's also used in cases where it is necessary to introduce changes that are fast that they eye can't register (in this case, for example, can be used in physics teaching to students presented the work of the internal combustion engine). Simulation objects can be carried out when the originals are too large or small, so we can't get to know their characteristics and ways of functioning.

From the above we can conclude that the simulation we can get to know with important properties of the objects or their functioning when for some reason can't do it from the original. It's very important for a lot of educational content because of course always easier and faster to remember to content that we can see a practical example that is practically acquainted with their characteristic and way of functioning.

III. CONCLUSION

From all this we can conclude that the use of visualization tools in the teaching of great importance. Primarily the use of programs that allow for the presentation of teaching content to be presented in colorful and fun way that students will understand in a way similar to the game and will

thus achieve greater effects of the class. It will also use visual tools to remove the monotony and boredom that is characteristic of the traditional school class and same turn into a fun way of learning.

Using animation and simulation are also essential means of achieving better effects of teaching. With simulation is possible to present the appearance, systems, machines or tools with witch it's necessary to work in a particular school class.

When students present practical application of a real model, when you are unable to see its internal structure and functioning, when informed about the ways of their connection, which is often complex and incomprehensible it's certainly more understandable and acceptable by the students.

From earlier elaboration there is one big conclusion that the process of visualization in the school and educational system certainly brings greatly increasing the impact of the adoption and application of knowledge by students.

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Self-Evaluation of Bi-lingual School Work

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Abstract - Organization of a bi-lingual school consists of all forms, ways and means of organizing and doing the school tasks. The organization of school life specifically includes the forms, organizational forms of educational activities: teaching, leisure activities, additional education and community work. Self-evaluation of the field of school work organization has enabled regular assessment of school work quality, to see what has been done so far and what can be done to improve the results. The survey analysis indicated the employees' opinion and needs regarding self-evaluation of school work organization. Moreover, a standardized scale by Serbian Ministry for school work self-evaluation has been used. The results can be used as initial points for action plan, with the aim to correct all the flaws identified through self-evaluation. The correction directly influences the improvement of organization of teaching, and therefore to improvement of the education itself. The paper emphasizes the following question: 'Are all the members of school board satisfied with the work organization and division of responsibilities?' The answer is that not all the members of the board are completely satisfied with the work organization and awarding system. They mostly lack motivation for team work and support by their colleagues. Irregular distribution of tasks, in relation to knowledge and experience, is a big problem at school. Due to this, the employees' efficiency is lower, records on efficiency scarcer and the system itself is unfair. A possible solution to this problem is additional education for school principals in the field of professional service organization and demanding greater responsibility from each employee.

I. INTRODUCTION

All bilingual schools compile annual reports on self-evaluation which essence should be the evaluation based on answers obtained through certain criteria. Self-evaluation within the field of school work organization has enabled regular assessment of the quality of school work organization, gain insight into things done so far and identify the things to be done in order to improve the results. The ultimate aim is to improve the quality of school work. Self-evaluation also means that the school is ready to accept the responsibility for its work and development. It is not the only form of work evaluation, but it is the basis for other types of evaluation. It also releases the school from the tension occurring as the consequence of external evaluation as the only form of monitoring and evaluating the work of educational institutions. By

introducing the self-evaluation, a school becomes the equal partner to external evaluators, who will do the evaluation using the identical markers, as well as the strictly defined procedures and mechanisms [14, 15].

School self-evaluation is a more or less complex system of procedures and instruments of quantitative and qualitative assessment of the quality and efficiency of numerous segments of educational work [5]. It comes as necessity in the development of contemporary school, which adapts to the needs of students and teachers, but also strives to correspond to the dynamic changes of postmodern society. The presented self-regulation of evaluation and self-evaluation can serve to school teams for research and self-analysis of their own development [12]. Introducing the change, evaluated in accordance with the requirements of contemporary pedagogy and educational systems of the future, we all become a part of the solution of quality we strive for. The formative evaluation contributes to the quality of education, increases the motivation for studying and enables greater achievements since the students exactly know what they are doing well and what badly, and also how to correct the bad moves and finally succeed.

The core of this approach is the curriculum, as the baseline of the quality school [3] and its constructive development procedure supported by teachers, students, parents and local development factors [7]. It includes abandoning the traditional and stimulating modern teaching tendencies and it is the integral, and not separated process of teaching and learning, i.e. school curriculum [13,10;5,3]. Its ultimate purpose is the self-evaluation as the important factor of teaching and learning process, and the special accent is on the influence of quality education on students' achievements [8].

Therefore, the adequate education is very important in order to have a positive effect on students' productivity. School evaluation and self-evaluation is a way towards quality and excellence. Pedagogical standards and/or indicators of these goals are the directives for monitoring, evaluation,

self-evaluation and evaluation of the impact of schooling. These standards are in fact the evaluation instruments, enabling for the user (student, teacher, parent) a structured and clear feedback on the quality of education and learning and it marks today's school as a learning organization and a lifelong source of resources [1]. From this point of view, experts [11, 2, 3,6] point out the value of building up and developing a supporting network or the structure of connecting, collaboration and partner relationships. By building partnerships (seeking, consolidating, uniting, determining, obliging…) and by introducing various changes, evaluated in accordance with the modern requirements of pedagogy and modern systems of the future, we all become a part of the solution of the quality we strive for.

The goals of teachers' evaluation and self-evaluation are associated with assuring the quality of teaching process and teacher's professional development with the aim to achieve high level of professional aspirations; openness towards change; will for experimenting in the teaching process and openness for critics and self-criticism; good knowledge of all aspects of teaching, subject and education area [2]. Faster and better achievement of the set tasks and goals needs the good organization. Defining the notion of organization depends on the aspect from which it is observed (economy, sociology, psychoanalysis…) and it usually includes a set of function with the aim to achieve certain goals while performing a job.

In this case specifically, it is about the organization of a bilingual school. It is made up of all the forms, ways and means of organizing and accomplishing the school's tasks. They are related to regular, additional and extended education, as well as extracurricular and free-time activities, school's cultural and public activities, as well as adults' education and health and social insurance of the students. The organization of school life specifically includes organizational forms of educational activity: teaching, free-time activities, additional work, and community work.

The organizing can be spontaneous (instinctive, unconscious) and conscious (planned and with a pre-set goal). In order for it to be understandable, it needs to include:

- Verifiable goals;

- Clear understanding of main duties;

- Agreed area of discretion or authority in order for a role holder to know what can be done in order to achieve goals.

The process of organization includes the following steps:

- Determining the bilingual school goals;

- Determining additional goals and bilingual school plans;

- Establishing and classifying the activities needed for the goals to be achieved;

- Grouping the activities, with the human and material resources in mind, as well as their best ways of use in the given circumstances;

- Authorizing heads of each group in order to implement the activities;

- Connecting the groups horizontally and vertically through authorization and information flow.

The main carrier of a bilingual school work organization is the school principal. His role is to manage all the types of knowledge which will satisfy current and future needs of contemporary society, in accordance with the school goals and through an adequate team, which he will create, build up and organize.

The society in question is qualified by fast and constant changes and use of technological achievements.In accordance to this, the school principal and staff need to invest in their constant professional development in order to quickly adjust to new ways of working, but also to the technologies used in education.

II. METHODOLOGY

A. Problem and subject of the research

All bilingual schools compile annual reports on self-evaluation which essence should be the evaluation based on answers obtained through the criteria. The subject of this study is to examine the bilingual school employees' and school board members' satisfaction with the organization of school work. As it has been previously mentioned, the self-evaluation is a procedure which evaluates the own practice and work. In this paper, the authors strive to establish the teachers' and bilingual employees' opinion on the quality of school work and organization.

B. Research aim and tasks

The aim of this research is to identify the strong and weak points of the observed school with bilingual education, regarding its work organization. The research tasks are based on the following:

1. Employees' satisfaction with the evaluation of bilingual school work organization, within the obligation distribution;

2. Organization and coordination of school work.

C. Research questions

Q1: Are all the employees satisfied with the school work organization?

Q2: Are the employees satisfied with the established and implemented rewarding system?

Q3: Are the employees satisfied with the distribution of duties and tasks?

D. The organization of research

The research was carried out in accordance with the questionnaire issued by the Ministry of Education and by the governments of Montenegro and Serbia, named 'A Handbok for self-evaluation and evaluation of school work'[14, 15]. The questionnaire has been handed out in Primary School 'Boško Strugar' in Ulcinj. This school is a representative sample for bilingual schools, situated in the city which is a real example of interethnic harmony. The sample included 45 employees working in the home school and its outposts, in Montenegrin and Albanian language. The obtained results have been presented as graphics and are expressed in percentages. The employees answered 5 statements by assessing their accuracy, i.e. the degree of their presence at school, as well as the importance of the given statement.

III. RESULTS AND DISCUSSION

The following indicators have been considered in this area:

- The distribution of duties and assignments;
- School work organization and coordination.

The results of the survey show that the majority of employees (80%) think that the duties are distributed according to the employees' knowledge, expertise and competence. The half of the employees (more precisely, 50%) think that the tasks are, within a team, completely or mainly assigned according to the employees' competence, but a lot of employees (40%) also think that this is not the case. 5% of them consider the assignment of the roles completely off the criteria. As of the equity of distribution of duties, 70% of employees consider it fait. The coordination of work by head teachers and professional services is considered as good by three quarters (75%) of the employees and somewhat over a half (55%) considers the coordination of professional and other bodies within

school as being good. Out of 40 teachers employed at this school, 4 are not professionals (11.2%, in percents), whereas the rest of 36 are professionally employed (88.8%). The four are teachers of music and mathematics. As for the non-educational team, all 100% of them are professionals.

All of the lower-grade teachers have the full number of classes in the working week (40 classes). As of the higher-grade teachers:

- 5 teachers (22.22%) have the full number of classes   (40 classes weekly - 100%);
- 3 teachers (11.11%) have 38 classes weekly (94.44%);
- 6 teachers (33.33%) have 36 classes weekly (90%);
- 1 teacher (5.55%) has 32 classes weekly (80%);
- 1 teacher (5,55%) has 28 classes weekly (70%);
- 1 teacher (5.55%) has 24 classes weekly (60%);
- 1 teacher (5,55%) has 20 classes weekly (50%);
- 1 teacher (5.55%) has 15 classes weekly (20%);
- 1 teacher (5.55%) has 13 classes weekly (20%).

E. The analysis of the research result

Based on the enalysis of the documents, the survey, discussion and observation, the following results have been derived:

- Distribution of duties and tasks

The majority of teachers are employed professionally (91.43%). The two teachers employed without profession are currently working to get the professional title in the field of the subject they teach. The information on the importance of assigning the duties and roles in accordance with the Law and its contribution to work efficiency, in the employees' opinion, is obtained through discussion and the survey. The non-teaching staff is 100% employed according to their professional title. Moreover, the employees think that the professionalism in education is highly valued.

- Organization and coordination of school work

The analysis of the survey shows that the majority of employees consider the cooperation

between the head teachers and professional services as good. The opinion of the employees differs regarding the coordination the work of managing, professional and other authorities. This inconsistency in work of certain authorities potentially a result of a bad communication channel, which leaves space for improvement.

When it comes to evaluating the school work organization, a conclusion can be derived on the basis of the documents, survey, observation analysis as well as the discussion with the employees - the results have shown that the sample school has the level of achievement 3. Therefore, we believe that it complies to the majority of the criteria used during our evaluation in the field, but there still are some areas which should be improved.

There is the will to work on this in the future by further taking care of the teachers' qualification and assigning roles on the basis of it. A better coordination and compatibility of teams will be strived for, as well as the equal task assignment within teams. Moreover, a continuous presentation of new resources to teaching and non-teaching staff shall be done, as well as the establishing of a more open channel of communication.

IV. CONCLUSION

Self-evaluation within school work organization has enabled regular assessment of the school work quality and to determine what has been donev up to now and what can still be done in order to improve the results. The survey analysis presented the opinion and need of the school employees. Since the school has been ranked by universal surveys and scale, it is possible to compare its results with the results of anther school within the field.

Moreover, the results can serve as an action plan starting points with the aim to correct all the flaws identified by self-evaluation. The correction directly influences the improvement of the teaching process organization, and therefore to the improvement of the education – which was the ultimate goal of the self-assessment process.

Finally, by achieving this goal, the goal of this research has been achieved. The questions like 'Are all the members of school board satisfied with the work organization, awarding system and role and task assigning?' led to the conclusion that the school board members are not completely satisfied with

work organization and awarding system. They lack motivation for team work and support from colleagues.

Unfair task assignment, in terms of knowledge and experience, is also a big problem at school, which leads to employees' lower efficiency and therefore worse records of each employee's performance. The ultimate consequence is the unfair application of the awarding system. A possible solution to this problem is additional education of the school principal on organizing the professional services and demanding higher responsibility from each employee.

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METHODICAL QUESTIONS OF NATURAL AND TECHNICAL SCIENCES SUBJECT TEACHING

"Mathematica" as a Tool for Characterization and Comparison of One Parameter Families of Square Mappings as Dynamic Systems

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Abstract - Comprehensive analysis and comparison of mappings as dynamical systems can be implemented with support of mathematical software. The most commonly used mathematical software that gives good results in the theory of dynamical systems, respectively in teaching and in scientific research is "Mathematica". In this paper we are going to use "Mathematica" for characterization and comparison of one parameter families of square mappings as dynamic systems. Their behavior will be viewed through the prism of the fixed points, finding and analyzing periodic points with period 2 and analysis of their bifurcation diagrams depending on the changing of real parameter.

I. INTRODUCTION

Comprehensive analysis and comparison of mappings as dynamical systems couldn't be imagined without the support of mathematical software. The most commonly used mathematical software in mathematics, which gives good results and has a simple programming codes is Mathematica. It is suitable as a teaching tool, helps the teacher-student correlation, and can be used in scientific surveys. In this paper, we will focus on the use of Mathematica in teacher-student correlation especially in section of mapping reviewed as dynamic systems.

As examples of characterization and comparison of one parameter families with using of Mathematica will be given the following square mappings

$$f(x) = Ax - x^2 \text{, for A>0} \qquad (1)$$

$$f(x) = 1 - Ax - Ax^2 \text{, for A>0} \qquad (2)$$

These square mappings depend only on one real parameter, A, and they represent one parameter families of mappings.

The square mappings reviewed as discrete dynamical systems are basically reviewed corresponding their differential equations

$$x_{n+1} = f(x_n) = Ax_n - x_n^2 \qquad \text{and}$$

$$x_{n+1} = f(x_n) = 1 - Ax_n - Ax_n^2 \text{ for } n \in N_0 \text{ , A>0}.$$

The characterization of these discrete dynamical systems refers to the characterization of the fixed points, finding and analyzing periodic points and analyzing their bifurcation diagrams depending on changing of the real parameter A, as the analysis in [1].

The analysis of square mappings, especially logistic mapping as square mapping can be found in mathematical literature (for example [2], [3], [4], [5], [6], [7], [8], [9], [10], [11]). These analysis and comparison of cubic mappings can be seen in [12].

The diagrams presented here are made in mathematical package Mathematica. During given analysis will be presented and a comparison between them. The codes for drawing these diagrams in Mathematica can be seen in [4], [5], [13], [14].

II. DISCRETE DYNAMICAL SYSTEMS

We will give a theoretical basis for notions: fixed points, periodic points, orbits and bifurcations, according to [1], [2], [4], [7], [8]. Each of these square mapping for A real parameter, is reviewed as difference equation $x_{n+1} = f(x_n)$ where $f : R \to R$ is the mapping. We analyze where point or subset of R is mapped iteratively with f. This difference equation $x_{n+1} = f(x_n), n \in N_0$ defines the discrete dynamical system (R, f) with dynamics $f^n, n \in N_0$, which is given by the iterations of the mapping f.

The mapping of the point x of R iteratively by f presents description of a trajectory of f with the start at the point x. The trajectory of f with the start at the point $x \in R$ is the array

$$x = x_0 = f^0(x), x_1 = f(x_0), x_2 = f(x_1) = f^2(x_0),$$
$$..., x_{n+1} = f(x_n) = f^{n+1}(x_0),...$$

The set of all maps $f^n(x)$ of x obtained with iteratively mapping by f is orbit of the point x and is marked with $orb(x) = \{y \mid y = f^n(x), n \in N_0\}$.

For the discrete dynamical system (X,R) defined by the difference equation $x_{n+1} = f(x_n) = f^{n+1}(x_0)$ the point $x \in R$ is called a fixed point for the map f if $f(x) = x$ i.e. $orb(x) = \{x\}$. The fixed points are the periodical points with the period 1. The fixed point can be stable point (attractor or attractive point) or unstable point (repeller or repulsive point) depending on the first derivative of the function at that point x i.e.

1. If $|f'(x)| > 1$ then x is unstable fixed point;

2. If $|f'(x)| < 1$ then x is stable fixed point.

For discrete dynamical system (X, R) defined with the difference equation $x_{n+1} = f(x_n) = f^{n+1}(x)$, the point $x \in R$ is called a periodical point of f if exist integer number *n>1*, for which $f^n(x) = x, f^{n-1}(x) \neq x$. The smallest positive integer *n* with this property is called a period of x. The orbit of the point x has exactly *n* points and it is called a periodical orbit.

Monitoring changes in a mapping depending on the parameters, resulting by a change of the parameter gives the dynamics of that mapping viewed as a discrete dynamical system. These qualitative changes are analyzed by drawing bifurcation diagrams for which dynamic system is reviewed as a function depending on a parameter. The drawing to such bifurcation diagrams couldn't be imagined without using mathematical software such as Mathematica.

III. CHARACTERIZATION OF FIXED POINTS

Here we give characterization of the fixed points of each of square mappings (1) and (2) when changing parameter *A*. Analytical, we find fixed point as a solution to the equation $f(x) - x = 0$, which can have two different solutions.

The graphical interpretations of the mapping $f(x)$ and their characterization of fixed points are given by describing the orbits of quite arbitrarily and conveniently selected points x.

Analytical for (1): By $Ax - x^2 = x$ the fixed points $x^{(1.1)} = 0, x^{(1.2)} = A - 1$ are obtained, which

are the real solutions for each $A > 0$. The programming code in Mathematica is given by solving equation $f(x) - x = 0$ with code

Solve[x²-(A-1)*x==0, x] which gives a solution {{x→0}, {x→-1+A}}.

We test the characterization of the fixed points with $|f'(x)| = |A - 2x|$. Where $|f'(x^{(1.1)})| = |A| > 1$ for $A > 1$, the fixed point $x^{(1.1)}$ is the unstable fixed point (repeller) and $|f'(x^{(1.1)})| = |A| < 1$ for $0 < A < 1$, the fixed point $x^{(1.1)}$ is the stable fixed point (attractor). For A=1 the fixed point $x^{(1.1)}$ is the stable fixed point of left and the unstable fixed point of right. In the equation $|f'(x^{(1.2)})| = |2 - A| < 1$ for $1 < A < 3$, the fixed point $x^{(1.2)}$ is the stable fixed point (attractor) and for $A < 1$ and $A > 3$ of $|f'(x^{(1.2)})| = |2 - A| > 1$, the fixed point $x^{(1.2)}$ is the unstable fixed point (repeller).

In figure 1 are given the orbits of the points x=-1 and x=3.2 with 4 iterations and the orbits of the points x=0.8 and x=2.5 with 200 iterations for the mapping $f(x) = Ax - x^2, A = 3$ where the fixed point $x^{(1.1)}$ is the unstable fixed point (repeller) of left and right, and the fixed point $x^{(1.2)}$ is the stable fixed point (attractor).
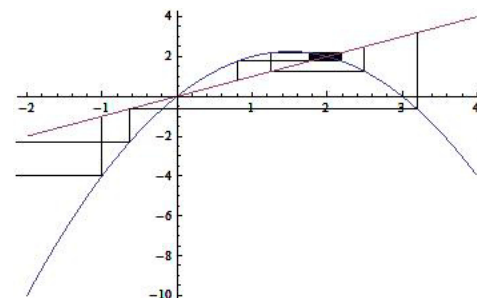
Figure 1 Orbits of the points x=-1, x=0.8, x=2.5 and x=3.2 for the mapping $f(x) = 3x - x^2$

Analytical for (2): by equation $1 - Ax - Ax^2 = x$ the fixed points

$$x^{(2.1)} = \frac{-(A+1) - \sqrt{A^2 + 6A + 1}}{2A},$$

$$x^{(2.2)} = \frac{-(A+1) + \sqrt{A^2 + 6A + 1}}{2A}$$

are obtained, which are the real solutions for each $A \neq 0$. The programming code in Mathematica is given by solving equation $f(x) - x = 0$ with code Solve [f[x] ==x,x] which gives the result

$\{\{x \rightarrow 1/2A(-1-A-\sqrt{1 + 6A + A^2}\,)\},$

$\{x \rightarrow 1/2A\,(-1-A+\sqrt{1 + 6A + A^2}\,)\}\}.$

We test the characterization in the fixed points with $\left| f'(x) \right| = \left| -A - 2Ax \right|$. Where $\left| f'(x^{(2.1)}) \right| = \left| 1 + \sqrt{A^2 + 6A + 1} \right| > 1$ for each $A > 0$, the fixed point $x^{(2.1)}$ is unstable fixed point (repeller) and $\left| f'(x^{(2.2)}) \right| = \left| 1 - \sqrt{A^2 + 6A + 1} \right| > 1$ for each $A \in (0, -3 + 2\sqrt{3})$ the fixed point $x^{(2.2)}$ is stable fixed point (attractor). For $A > -3 + 2\sqrt{3}$, $\left| f'(x^{(2.2)}) \right| = \left| 1 - \sqrt{A^2 + 6A + 1} \right| > 1$ the fixed point $x^{(2.2)}$ is unstable fixed point (repeller). For $A = -3 + 2\sqrt{3}$, $\left| f'(x^{(2.2)}) \right| = \left| 1 - \sqrt{A^2 + 6A + 1} \right| = 1$ the fixed point $x^{(2.2)}$ is stable of left, but it is unstable of right.

In figure 2 is given the orbit of the points x=-7 and x=2.5 with 4 iterations and orbit of the point x=-4 for 100 iterations for the mapping $f(x) = 1 - Ax - Ax^2, A = 0.2$ where can be seen that the point $x^{(2.2)}$ is stable fixed point (attractor), but the point $x^{(2.1)}$ is unstable fixed point (repeller).
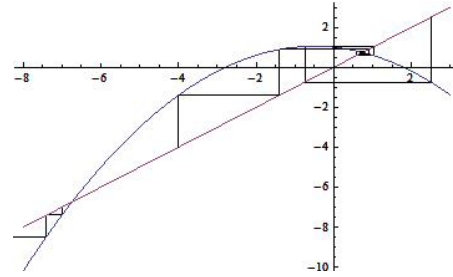
Figure 2. Orbit of the point x=-1.5 for the mapping $f(x) = 1 - 0.2x - 0.2x^2$

The programming code in Mathematica for drawing graphs as ones in the figure 1 and in the figure 2 allows a good display for the orbits of the different points in each mapping that can help in a correlation between teachers and students. According to programming codes in [13], we will give the code for the orbit of the point x=-1 in the square mapping $f(x) = 3x - x^2$:

1. Defining a mapping

qvad[A_]:=Function[$x, A*x-x\char`\^2$];

2. Defining the orbit for the point x=-1 with 4 iterations and its drawing in 2D space,

Orbit [map_, x0_, n_]:=NestList[map,-1,4]

Iterative Process[map_,x0_,{min_,max_}]:=

Module [{fr,orb},orb=Orbit[map,-1,4]

fr=MapThread[Line[{{#1,#1},{#1,#2},{#2,#2}}]&,

{Drop[orb,1],Drop[orb,1]}];Show[Plot[{map[x],x},

{x,-2,2}],Graphics[{fr}]]]

tretgrafik1=Show [GraphicsArray[{Iterative Process [qvad[3], -1,{−1,2}]}]]]

The programming codes for orbits of the remaining points of the graphs in the figure 1 and figure 2 for the following square mappings are identical with an already given ones.

IV. CHARACTERIZATION OF THE PERIODICAL POINTS WITH THE PERIOD 2

Analytically, finding of periodical points with a period n is obtaining a solution for the equation $f^n(x) - x = 0$. For every polynomial $f(x)$ with the exponent 2, n-the iteration $f^n(x)$ is the polynomial with the exponent 2^n and it has maximum 2^n various solutions. For the periodical points with the period 2, we obtained the solution of

the equation $f^2(x) - x = 0$ which is the polynomial equation with the exponent 4 and it can have maximum $2^2 = 4$ solutions. Two of the solutions are the fixed points for $f(x)$ and other two are the periodical points with the period 2 which is fixed points for $f^2(x)$.

Analytical for (1): From equations $f^2(x) = -x^4 + 2Ax^3 - (A^2 + A)x^2 + A^2 x$ and $f^2(x) - x = 0$ the solutions $x^{(1.1)}$, $x^{(1.2)}$,

$$x^{(1.3)} = \frac{A + 1 - \sqrt{A^2 - 2A - 3}}{2},$$

$$x^{(1.4)} = \frac{A + 1 + \sqrt{A^2 - 2A - 3}}{2}$$

are obtained, which are the fixed points of the second iteration $f^2(x)$ for the mapping $f(x)$. The programming codes in Mathematica marked by (3) for obtaining $f^2(x)$ and the fixed points $x^{(1.1)}$, $x^{(1.2)}$, $x^{(1.3)}$, $x^{(1.4)}$ are:

1. Defining function $f[x\_]:=A*x-x\text{^}2$;

2. Finding $f^2(x)$ with Expand [f[f[x]]] and obtained result A² x-A x²-A² x²+2 A x³-x⁴;

3. Finding of the fixed points $x^{(1.1)}$, $x^{(1.2)}$, $x^{(1.3)}$, $x^{(1.4)}$ with Solve[A² x-A x²-A² x²+2 A x³-x⁴==x,x] and the obtained result is

{x→1/2(1+A-$\sqrt{-3 - 2A + A^2}$)},

{x→1/2 (1+A+$\sqrt{-3 - 2A + A^2}$)}}.

The derivate of second iteration $(f^2(x))' = -4x^3 + 6Ax^2 - 2(A^2 + A)x + A^2$ with the programming code marked with (4),

D [A² x-A x²-A² x²+2 A x³-x⁴, x] gives the result $-4x^3 + 6Ax^2 - 2(A^2 + A)x + A^2$ where for the fixed points we obtain $(f^2(x^{(1.1)}))' = A^2$, $(f^2(x^{(1.2)}))' = (A - 2)^2$ and $(f^2(x^{(1.3)}))' = (f^2(x^{(1.4)}))' = 4 + 2A - A^2$ (obtained with a programming codes).

Expand $[-4x^3 + 6Ax^2 - 2(A^2 + A)x + A^2 /.x \to 0]$ with result A^2 and

Expand $[-4x^3 + 6Ax^2 - 2(A^2 + A)x + A^2 /.x \to A-1]$ with result $4 - 4A + A^2$.

The absolute value $|(f^2(x^{(1.1)}))'| = A^2 > 1$ for $A > 1$ shows that fixed point $x^{(1.1)}$ is still unstable fixed point (repeller). For $0 < A < 1$, the derivate is $|(f^2(x^{(1.1)}))'| = A^2 < 1$ and the fixed point $x^{(1.1)}$ is still stable fixed point (attractor).

The absolute value $|(f^2(x^{(1.2)}))'| = (A - 2)^2 > 1$ for $A > 3$ or $0 < A < 1$ shows that fixed point $x^{(1.2)}$ is still unstable fixed point (repeller). But, for $1 < A < 3$ the derivate is $|(f^2(x^{(1.2)}))'| = (A - 2)^2 < 1$ and the fixed point $x^{(1.2)}$ is still stable fixed point (attractor).

For $A \in (3, 1 + \sqrt{6})$, is obtained $|4 + 2A - A^2| < 1$ then the fixed points $x^{(1.3)}$, $x^{(1.4)}$ with the period 2 are the stable fixed points (attractors). The points $x^{(1.3)}$, $x^{(1.4)}$ form an orbit { $x^{(1.3)}$, $x^{(1.4)}$ } which is the orbit-attractor.

In figure 3 a) the first and the second iteration of the mapping $f(x) = Ax - x^2, A = 4$ with two fixed points $x^{(1.1)} = 0$, $x^{(1.2)} = 3$ with period 1 and two fixed points $x^{(1.3)} = \frac{5 - \sqrt{5}}{2}$, $x^{(1.1)} = \frac{5 + \sqrt{5}}{2}$ with period 2, are given.
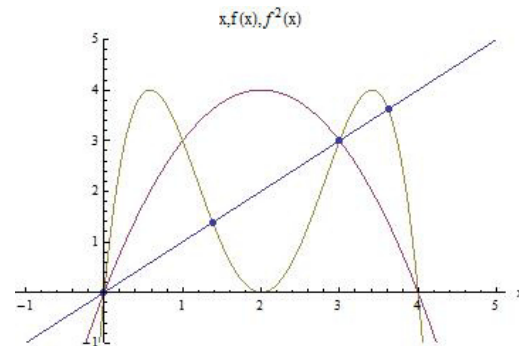
Figure 3.   The first and the second iteration of mapping $f(x) = 4x - x^2$ with fixed points with the period 1 and 2

The programming code in Mathematica marked by (5) for the figure 3 is:

1. Defining a function with $h[x\_] := 4x - x^2$;

2. Drawing the first and second iteration of h(x) and y=x with codes

k1=Plot[{x,h1[x],Nest[h1,x,2]},{x,-1,5}, PlotRange→{-1,5},AxesLabel→{"x"}];

3.Drawing of fixed pointes with codes k2=ListPlot[{{0,0},{3,3},{1/2(5-$\sqrt{5}$), 1/2(5-$\sqrt{5}$)},

{1/2(5+$\sqrt{5}$),1/2(5+$\sqrt{5}$)}},PlotStyle→

AbsolutePointSize[5]];

4. Presenting k1 and k2 in the same 2D coordinate system with code Show [{k1, k2}].

Analytical for (2): From

$$f^2(x) = -A^3 x^4 - 2A^3 x^3 + (3A^2 - A^3)x^2 + 3A^2 x$$
$$+ (1 - 2A)$$

and $f^2(x) - x = 0$ the solutions $x^{(2.1)}$, $x^{(2.2)}$,

$$x^{(2.3)} = \frac{1 - A - \sqrt{A^2 + 6A - 3}}{2A}$$

$$x^{(2.4)} = \frac{1 - A + \sqrt{A^2 + 6A - 3}}{2A}$$ are obtained, which

are the fixed points of the second iteration $f^2(x)$ for the mapping $f(x)$. Program codes used to obtain $f^2(x)$ for the mapping (2) and fixed points $x^{(2.1)}$, $x^{(2.2)}$, $x^{(2.3)}$, $x^{(2.4)}$ in Mathematica are the same as codes in (3).

The derivate of second iteration for (2) is

$$(f^2(x))' = -4A^3 x^3 - 6A^3 x^2 + 2(3A^2 - A^3)x + 3A^2$$
and the derivate in the fixed points is

$$(f^2(x^{(2.1)}))' = A^2 + 6A + 2 + 2\sqrt{A^2 + 6A + 1},$$

$$(f^2(x^{(2.2)}))' = A^2 + 6A + 2 - 2\sqrt{A^2 + 6A + 1},$$

$$(f^2(x^{(2.3)}))' = (f^2(x^{(2.4)}))' = 4 - 6A - A^2.$$

Program codes are identical to (4) when applied mapping (2).

The absolute value

$$| (f^2(x^{(2.1)}))' |=| A^2 + 6A + 2 + 2\sqrt{A^2 + 6A + 1} |> 1$$

for $A > 0$ shows that a fixed point $x^{(2.1)}$ still is an unstable fixed point (repeller). The absolute value $$| (f^2(x^{(2.2)}))' |=| A^2 + 6A + 2 - 2\sqrt{A^2 + 6A + 1} |> 1$$

for $A > -3 + 2\sqrt{3}$ shows that a fixed point $x^{(2.2)}$ is still stable fixed point (attractor). For $A = -3 + 2\sqrt{3}$,

$$| (f^2(x^{(2.2)}))' |=| A^2 + 6A + 2 - 2\sqrt{A^2 + 6A + 1} |= 1$$

the fixed point $x^{(2.2)}$ is stable of left, but unstable of right.

For $A \in (-3 + 2\sqrt{3}, -3 + \sqrt{14})$, is obtained $\left| 4 - 6A - A^2 \right| < 1$ and the fixed points $x^{(2.3)}$, $x^{(2.4)}$ with period 2 are the stable points (attractors). The points $x^{(2.3)}$, $x^{(2.4)}$ form an orbit $\{ x^{(2.3)}, x^{(2.4)} \}$ which is the orbit-attractor.

In figure 4 are given the first and second iteration of the mapping $f(x) = 1 - Ax - Ax^2, A = 1$ with the two fixed points $x^{(2.1)} = -1 - \sqrt{2}$, $x^{(2.2)} = -1 + \sqrt{2}$ with period 1 and the two fixed points $x^{(2.3)} = -1$, $x^{(2.4)} = 1$ with the period 2.
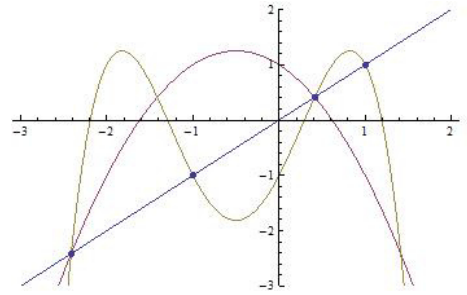
Figure 4.   The first and second iteration of the mapping $f(x) = 1 - x - x^2$ with the unstable points with period 1 and 2

The program codes in Mathematica to obtain the first and second iteration and unstable points are identical to the codes (5) for mapping (2).

V.   BIFURCATION DIAGRAMS

The reviewed square maps (1) and (2) in the unstable points are entering the cycle with period 2,4,8 ... Here we review their bifurcation diagrams on which appearance of bifurcations can be seen with focus on the first bifurcation, where periodic points with period 2 appear. These periodic points with period 2 have already been reviewed. Graphical presentation using mathematical software is a great tool for students to see and analyze the mapping when real parameter A is changed.

The bifurcation diagram of (1) is given in the figure 5 a), and the bifurcation diagram of (2) is given in the figure 5 b).

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a) Bifurcation diagram of the mapping

$$f(x) = Ax - x^2$$

b) Bifurcation diagram of the mapping

$$f(x) = 1 - Ax - Ax^2$$
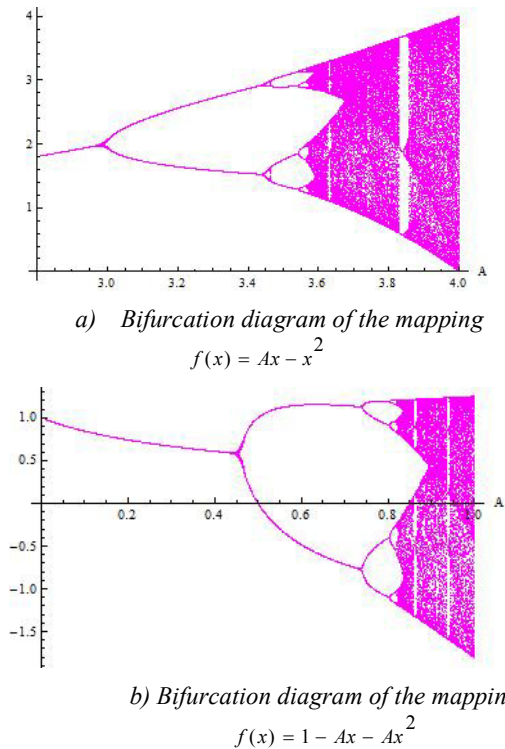
Figur*e 5.*   Bifurcation diagrams

First bifurcation of the mapping (1) appears for *A*=3, and the first bifurcation of the map (2) appears much earlier for A=-3+2$\sqrt{3}$ i.e. for 0.4<A<0.5.

The programming codes in Mathematica for obtaining bifurcation diagrams of the mappings as dynamical systems can be found in [4]. These codes used for square mapping (1) are

1. Defining of mapping with: f (x) =Ax-x^2;

2. Defining the starting point, the step, the iterations and their number and at the end drawing graph with codes:

x0=0.1;stepsize=0.001;Itermax=200;

iterate=Compile[{mu},Map[{mu,#}&,Union[Drop[NestList[# (mu -#)&,x0,Itermax],100]]]];

pts=Flatten[Table[iterate[mu],{mu,x$_1$,x$_2$,stepsize}],1];

ListPlot[pts,PlotStyle→{PointSize[0.001],RGBColo r[1,0,1]},AxesLabel→{"A"}]

The program code for the mapping (2) is identical with the programming code for the mapping (1).

VI. CONCLUTION

Using mathematical package in dynamic systems such as Mathematica is more than needed. Obtaining the fixed points of the first and second iteration of mapping is bulky and requires solving complex algebraic equations. This process without using a computer is tough and very time-consuming in some cases is even impossible. Using computer is necessary, especially if third, fourth or iteration of higher order is tested. Especially in teaching process and process in student learning, using visualization obtained with these kinds of software is essential for students to understand the mathematical concepts. Bifurcation's diagrams without computer software is impossible to be obtained, therefore can be very difficult to be understood without good visualization.

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Didacic Principle Of Visualisation In Teaching Mathematical Functions

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Abstract - The principle of visualization is a fundamental principle in teaching mathematics and helps in the realization of other didactic principles. Mathematics instruction in its nature involves the study of concepts, attributes, statements and issues are intrinsically related to certain dynamic process or situation. With introduction of symbolic in early algebra courses, the student has to start think dynamically – what happens if that symbol is replaced with this value, and what changes if some other value is used? With every exercise in geometry, student is forced to ask himself what happens if some geometric object changes. In particular, the study of functions leads student to permanently exploring the changes. Learning mathematical functions is learning the concept of changes especially when it comes to notions of continuity, limit and other fundamental concepts of the calculus.

The principle of visualization should be raised to a higher and more significant level, because visualization refers not just how to "see", but the engagement of the whole perceptual apparatus of the student.

We will show that the perception in the teaching process should be enriched by all possible means and visualization methods, up to the level where the external review team may replace the internal one. The concept of mathematical thinking and the aspects of mathematics cognition are presented as well.

I. INTRODUCTION

Didactical principles are general requirements that must be satisfied by instruction to successfully archive its goals [1].

Principle of visualization is a fundamental principle in mathematics instruction and it helps realization of other didactical principles, since visualization is external support of mental activities [2].

Didactical principle of visualization in mathematics instruction is requirement to apply visualization tools in the instruction. The goal of such application is to achieve high level of abstraction during formation of the mathematical concepts.

There are two types of visualization concerned in classical didactics:

- Symbolic visualization

- Object visualization

Symbolic visualization could be reached by: figures, graphics, tables, pictures, photos, schemes, diagrams, graphs of binary relations…

Visualization of 3-dimensional, spatial situations using figures or graphics is problematic issue in mathematical instruction. Usually, 3D situation is pictured 2-dimensionally (on paper, board or monitor) which includes projection as a transformation. Projection is not intuitive and clear for many students. It is recommended to combine such tools with spatial models, at least at the beginning, during establishing the required connection or until the student is able to make spatial representations himself [2].

Object visualization could be reached by: plane figure models, spatial models, 3D bodies' models…

Model is physical interpretation of some spatial situation and could be made of any material. Interactions of few objects could be finding at the some models. Intersection of 3D geometrical figures with given plane, for example.

As information technology (IT) became widely used in contemporary instruction, didactical principle of visualization enlarges its power. Producing of precise and picturesque representations is faster and easier now. Most of the mathematics teachers are able to produce visualization tools related to every exercise and to every theorem. Much such visualization is available on internet and can be implemented in mathematics instruction. Teacher's networks could be used for collaborative learning. Teachers can share and interchange their didactic materials and make them available to their students. That means to move instruction from real classroom to asynchronous virtual classroom.

Mathematics instruction, by its nature, includes learning concepts, properties, statements and problems strongly connected to some dynamic process or situation. With introduction of symbolic in early algebra courses, the student has to start think dynamically – what happens if that symbol is replaced with this value, and what changes if some other value is used? With every exercise in geometry, student is forced to ask himself what happens if some geometric object changes. Learning functions especially brings student to permanent research of the changes. The essence of learning functions is the concept of change, especially learning of concepts like continuity, limit, derivative and other important calculus concepts.

Principle of visualization should be raised to higher and more significant level, because visualization means not only "how to see", but also how to engage entire perception of the students.

II. WHAT IS VISUALISATION?

Before defining the concept of visualization, should be noticed that several synonyms of visualization or terms very close to it can be found in the relevant literature. Some of the authors are using "visual representation", "visual media", "visual literacy", "visual communication skills", "illustrations" and "media illustrations".

Philips, Noris and Macnab [3] have researched wide spectrum of literature and have published review of some definitions of visualization (p. 23-26). Some of them are cited below.

Simplest, but also very tight definition is given by Habre (1999): "Visualization is the process of using geometry to illustrate mathematical concepts".

Visual literacy is defined by Hortin (1982) like "ability to understand and use images and to think and learn in terms of images i.e., to think visually".

Sharma (1985) understands visualization as "mental imagery serves as a kind of 'mental blackboard' on which ideas can be developed and their implications explored". In practice, mathematics teacher is permanently trying to show the students what "he is seeing on his invisible monitor" and to lead them "to see the same on their own invisible monitors", or like Sharma said – on the mental blackboards.

According to Arnheim (1991), "visualization refers to the cognitive function in visual perception. In visualization, pictures combine aspects of naturalistic representation with more formal shapes to enhance cognitive understanding".

"Spatial visualization is the ability to manipulate an object in an imaginary 3-D space and create a representation of the object from a new viewpoint" (Strong, Smith 2001).

From didactic of mathematics point of view, next three definitions seem to be the most relevant. "Spatial visualization, the ability to understand accurately three-dimensional (3D) objects from their two-dimensional (2D) representation" (Korakakis, Pavlatou, Palyvos, Spyrellis, 2009). "Particularly, in the context of mathematical problem solving, visualization refers to the understanding of the problem with the construction and/or the use of a diagram or a picture to help obtain a solution" (Deliyianni, Monoyiou, Elia, Georgiou, Zannettou, 2009). "Visualization is defined in terms of understanding transformations on structure and relating these with function" (Maihai, Ramadas, 2009).

Since understanding the abstract concepts is one of the most important goals of the mathematics instruction, didactical principle of visualization and its importance can be seen more clearly respecting that "Visualization is a central component of many processes for making transitions from the concrete to the abstract modes of thinking. It is a tool to represent mathematical ideas and information, and it is used extensively in the middle grades" (BenChaim, Lappan, Houang, 1989).

In general, one can consider next definition (Gilbert, Reiner, Nakhlen, 2008) as most comprehensive and most acceptable. "Visualization is concerned with External Representation, the systematic and focused public display of information in the form of pictures, diagrams, tables... It is also concerned with Internal Representation, the mental production, storage and use of an image that often (but not always...) is the result of external representation. Visualization can be thought of as the mental outcome of a visual display that depicts an object or event."

Resuming all definitions given by different authors, visualization is complex concept, composed of:

- Physical visualization – pictures, figures, diagrams, 3D representations, scheme representations… maybe even with sound and other sense effects included, and they may appear on different media: paper, computer monitor, slide…

- Introspective visualization – mental objects created by some person, believing they are same or similar as a physical objects modeled as some form of physical visualization.

- Interpretative visualization – converting physical object, or introspective visualization

into some form of knowledge – cognitive storage of existing network of believes, attitudes, experience, understandings, facts and generalizations.

III. VISUALISATION AIDED LEARNING

Implementation of the visualization methods in mathematics instruction is effective only if those methods meet the functions relevant for achieving didactical aims. Scheiter, Wiebe и Holsanova [4] define 2 such functions:

- Instructional functions of the visualization as messages they contain their own.

- Instructional functions of the visualization as addition of the verbal messages.

No matter visualization is used with or without verbal explanation, they could possess following functions:

- Influence to motivation.

- Substitute or addition for real life experience.

- Visio-spatial reasoning.

The last one is important since visualization is not limited to memory support, but it allows achieving higher cognitive levels. Cognitive operations are aided by external representations. Otherwise they ask for more cognitive effort.

Visualization methods should be support of deductive reasoning and the process of reasoning based on perception. Those methods allow perceptive reasoning to be replaced by deductive logical thinking, which is more important.

Second function of the visualization is used more often since such methods are almost always used combined with some verbal method.

Following functions refer to visualization as addition of the verbal messages:

- Decorative function (often has negative influence, too).

- Representative function.

- Organizational function.

- Transformation function.

According to its representative function, visualization makes content more concrete. Diagrams, tables, schemes allow organizational function of the visualization. Transition from concrete to abstract thinking is very important in mathematics instruction. High quality visualization allows such transition using the transformation function of the visualization.

Visualization with transformation function has the strongest positive influence to achieving didactical goals. That means visualization deftly targets some specific important piece of information, allowing easy memorizing in concrete form, connecting to other content as a part of the system of knowledge and allowing easily undertaking of that piece of information from memory and its usage and application.

Visualization aided learning does not depend only of the functions of the applied teaching methods. Student's personal features have significant influence on effective visualization learning. Scheiter, Wiebe и Holsanova [4] classify that features as follows:

1. Cognitive capabilities

   - Imagery competencies: perception, interpretation, understanding and using of pictures and images.

   - Visual literacy: ability of decoding of pictures, understanding and connecting visual features of the representations to interpretation of the objects or the content.

   - Pre-knowledge about specific domain: student with higher pre-knowledge level is better in focusing on relevant information.

   - Visio-spatial abilities: ability for transforming 2D or 3D world objects mentally and ability to imagine changes on that object after such transformation.

2. Cognitive style

3. Preferring visual instead of verbal

Cognitive style is psychological dimension representing consistency in the way of a person's adopting and processing of some information.

Style differences between individuals refer to the way a person prefers to obtain information: visual or verbal. Two types of students could be found, according to such preferences:

- Visualization.

- Verbalization.

Additionally, in the case of individuals who prefer visual representations could be distinguished ones who rather focus on scheme interpretations, location of the objects and spatial connections between them (spatial visualization), and ones who rather focus on shapes, size, color, light (iconic visualization).

IV. NEGATIVE EFFECTS OF VISUALISATION METHODS

Usage of visualization methods should not be goal just to apply such methods. If such methods are applied because of their decorative function, to make text, presentation or class more interesting and the connection to the content is missed, there should be raised student's interests and motivation, but it could lead student to defocusing from the essence of the learning process. There are many articles about the influence of usage of colors for example, to the student's perception and feelings during the learning process. One can conclude that usage of colors or generally, any form of visualization, should be compatible to the didactical aims and should be engaged only as a tool for achieving that aims. In general, superfluous and irrelevant information of any kind have negative influence on the process of learning. However, visual representation could contain information included in verbal representation, but if such overlap is used to make the both of representation complementary, then there is not the case of using superfluous information.

Visualization should not be used too often. That could have negative influence on student's ability to think abstractly, and to slow down the development of such student's abilities. To achieve the aim of developing abstract thinking, visualization methods are powerful and often indispensable. However, after some time, student should attend to the level – without visualization to be able to understand some abstract concepts.

So, in mathematics instruction, perception should be enriched with all possible visualization methods, until external representation can be replaced by the internal one.

V. TEACHING MATHEMATICAL FUNCTIONS. MATHEMATICAL THINKING. MATHEMATICAL COGNITION

During mathematics instruction, especially on tertiary (university) level, every student should be lead to the highest cognitive levels. Teaching mathematical functions is fundamental for the university mathematics.

Learning end exploring mathematical functions is important for student's development. He must go through several mental processes to attain to quality and essential knowledge about mathematical functions. Teachers and education researchers should be aware of that. That leads to the mathematical thinking issue.

In the general didactics of mathematics, based on contemporary pedagogical and psychological theories, there are many attempts to find answers of the following question. Which kind of thinking is mathematical and what are its features? The phrase mathematical thinking does not mean it is something isolated and specific only in some mental activity. Different subject or science areas use different methods in reasoning and structuring of the knowledge.

On dependence on the object of interest of some subject or science, some approaches and methods arise as dominant or almost only acceptable. Mathematical thinking should be understood exactly like that. Some elements of approaches and methods specific for mathematical thinking can be found in other subject or sciences, but in the mathematics they are only acceptable [2] (p. 39-44).

At every stage of learning mathematics, part of the didactic goals concerns about applying concrete operations and about performing procedures or algorithms. If instruction is organized such that only those goals are imperatively asked, there is a risk to obtain wrong perception the process is successful. Some of the students may acquire skills to perform such operations without essential understanding of the general logical connections. That is so-called formal knowledge [5] (p. 106-121).

The real development of the mathematical thinking means to develop abilities for abstract concepts adoption, deductive logical system adoption, discovering the relations between the objects in dynamical background, managing changes in dependence on changes of some other parameters, to the creative stage where one who thinks mathematically discovers new relations and solves problems which solutions give new questions and lead to directions of pursuit to their answers.

Opportunity to obtain abilities for mathematical thinking is determined by subjective person's character. Some of them, especially motivation can be developed during the teaching process.

Important thinking styles are: elasticity, activity, memory, latitude, depth, criticality, self- criticality, clearness, brevity and originality. The form of the mathematical thinking depends on quality of the thinking which determines the thinking style.

According to content of thinking, one can stand out following types of mathematical thinking:

- Concrete thinking
- Abstract thinking
- Logical thinking
- Spatial-scheme thinking
- Intuitive thinking

- Functional thinking

- Creative thinking

If mathematical instruction is focused on learning of mathematical functions, naturally, functional thinking is one of the most important types. Reason to stand out special type of thinking, called functional thinking is the importance of the function in contemporary mathematics and they are in the fundament of almost all natural processes and one of the most power tools for cognition of the real world.

"Basic feature of functional thinking is ability to understand the general and partial relations between mathematical objects or between their properties and skills to use them and apply them in practice" [1] (p. 226).

Student who needs to develop functional thinking should be able to understand changes, dependences between input and output variables, concerning dynamical nature of the real world and consequently the dynamical nature of the mathematical models used for description and exploration of such real world problems. "No other concept does not represent activity, flexibility and dynamic nature of the real world with such straightness and such concrete like the concept of mathematical function" [6] (p. 360-361).

Special (thematic) didactic of mathematics, which concern about teaching mathematical functions, mostly deals with questions how and when introduce that concept.

Functions usually are part of the content of higher level high school programs and university level mathematics syllabi, especially for technical and engineering students. Special (thematic) didactic of mathematics, gives answers for issues like how to teach concepts as limits, continuity of functions, derivatives and integrals, functions of several variables, partial derivatives, multiple integrals… Ivanov [6] gives detailed review of the methodologies for all of those concepts. Bradis [5] has similar approach. He suggests the way of systematization of the content concerned to mathematical functions teaching. That is important especially for taking account of student's pre-knowledge before starting some kind of advanced calculus course. Methodology of the special (thematic) didactic, is there directed to the content and there are lot of examples how to avoid formal knowledge and how to help students to obtain fundamental knowledge in this area. That means there are mostly recommendations for the order of introducing the concepts. It is particularly important to capture the logical structure of such content – to give answers how attention is needed to pay on

proving theorems, how general approach is needed for essential understanding of that content.

However, classical didactics (both, general and thematic) of mathematics does not provide precise answers to all of the questions related to mathematical thinking. Mathematical cognition is the area of interest where should be directed to.

Area of interest of the mathematical cognition is related to the cognitive and neurological processes as a background of numerical and mathematical abilities. Domain of the mathematical cognition can be described through following questions [7]:

Which way human mind represents numbers and do mathematical operations? What is the fundament of the cognitive development of the numerical and mathematical abilities? Which factors have influence on numerical concepts and procedures? Do people and animals share similar numerical representations and processes? What is a fundament of numerical and mathematical difficulties and how to exceed them?

Many researches in the area of mathematical cognition have these issues as a fundament. But, learning mathematics demands achieving of higher cognitive levels. Nunez and Lakoff [8] are asking for some other questions in the area of mathematical cognition. They are going significantly beyond the domain of arithmetic, respecting specific features of the mathematics as a science. Mathematics teaching has to concern of the deductive structural organization of the mathematics. This point of view of the mathematical cognition is relatively novel and needs more exploration. It direct to research of the manner how human mind creates and organizes deductive a logical structure, how it handle with formal systems, axioms, deducing conclusions, proving theorems and other form of advanced mathematics forms.

Nunez and Lakoff [8] ask following questions: "which cognitive mechanism is used for structuring mathematical ideas? More specific, which cognitive mechanisms can characterize deductive organization of such mathematical ideas?" To determine the concept of deductive organization, the authors introduce so-called "conceptual metaphor".

It is especially important to explore usage of conceptual metaphor from teaching mathematical functions point of view. This is essential for organizing successful calculus instruction, since there is the conflict between intuitive understanding of mathematical situation and the formal mathematical logic system most evident. Nunez and Lakoff start from so-called basic metaphor of infinity and describe sequence of conceptual metaphors one must go through to achieve essential understanding

of the concepts of limit, curve and other calculus main concepts. Asking for the roots in the historical overturn in XIX century, after Cauchy, Dedekind and Weierstrass when contemporary calculus theory is re-conceptualized fundamentally on different way. Before, continuity considered to holistic and dynamic objects moving in the space. Kepler, Euler, Newton and Leibniz have built their theories based on such understanding of the continuity. This is an idea which students bring intuitively on mathematics classes at the beginning of calculus study. It should be dramatically change using new conceptual metaphors where the space is imagined as something composed of sets of discrete elements called points. Moving through the metaphorical space is replaced by exact statements with existential and universal quantifications operating with discrete sets of points.

In the future, answers of all this issues will be given by the researches from the area of mathematical cognition. That should be direction for developing novel didactical ideas.

VI. CONCLUSION

Avoiding formal knowledge in learning concepts related to mathematical functions and other similar concepts from calculus is still great challenge in didactic of mathematics.

Visualization methods and various techniques arising from didactical principle of visualization should be used by teachers for improving teaching calculus and other mathematical concepts, especially concepts related to mathematical functions.

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Mathematical Modeling, Analysis and Optimization Using MMANA - Mathematical Modeling and Antenna Analysis Software

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Abstract - After using a modeling mathematical model of the radio link in excel, we have got the measures of strengthening the antennas (in this instance they amount to 15 dBi), approach to mathematical modeling of antennas. For this purpose you use special software for modeling and analysis of antennas (MMNA - Mathematical Modeling and Antenna Analysis). The software uses extremely complex mathematical formulas more interdependent and conditional variables such as: - the interaction between the elements of the antenna; - Impact of the country of the characteristics of the antenna depending on the height of the antenna and the frequency or wavelength; - Impact of items and objects near the antenna depending on the electrical conductivity that is, magnetic permeability of objects and buildings; - Resonant frequency of the antenna; - Impedance antenna and adjust to impendency cable; - Orientation and a horizontal, vertical angle of radiation of antenna and others.

Each antenna element of the software breaks down hundreds of segments and each element making calculations, comparison with other segments of the same or neighboring elements and ultimately optimizing. The size, type of material and the location of each element of the antenna is defined in a separate part of the 3D coordinate system.

I. INTRODUCTION

With the advent of the Internet, the communication as one of the basic needs of people gets completely new dimension. We are witnessing that the Internet slowly but surely change our life. The number of Internet users is growing daily and for many, the Internet is a growing need and in television for example. Day by day the number and quality of the content accessible via the Internet (pictures, music, videos, movies, e-books and much more) is increasing. This in turn implies a need for greater transmission speeds. Today, constant about the Internet is a daily necessity and modern business cannot do without access to fast and stable Internet.

In urban areas, stable access to the Internet is not difficult to provide. There are a number of cable operators and other ISPs that offer plug at relatively reasonable prices. Unlike the cities, in rural areas and outside major towns where there are no built cable communication networks to access quality and stable Internet is not so simple, and opportunities for providing internet connection is limited. Under such conditions, most commonly used wireless microwave radio links that ensure quality transmission of Internet traffic over long distances up to several tens of kilometers. The main condition is that there is optical visibility between the place where there is Internet access and a quality place where to deliver Internet.

For each particular situation and specific use antennas mathematically modeled depending on several variables, such as required reinforcement type and diameter of material, frequency attenuation in terms of distance, the required area should be covered with signal level mount antenna from the wireless radio link, cable and device receiver sensitivity of the Wi-Fi router, power transmission from Wi-Fi router, the influence of nearby objects and objects and the like. When constructing a mathematical model of the radio link, the mathematical model the necessary antennas and modeling of the large number of variables which affects the ultimate success; you need a sound knowledge in the field of radio technology, electromagnetic theory of radiation and radio waves stretching.

II. (MMANA - MATHEMATICAL MODELING AND ANTENNA ANALYSIS SOFTWARE)

After using a modeling mathematical model of the radio link in excel, we have got the measures of strengthening the antennas (in this instance they amount to 15 dBi), approach to mathematical modeling of antennas. For this purpose you use special software for modeling and analysis of

antennas (MMNA - Mathematical Modeling and Antenna Analysis). The software uses extremely complex mathematical formulas more interdependent and conditional variables such as: - the interaction between the elements of the antenna; - Impact of the country of the characteristics of the antenna depending on the height of the antenna and the frequency or wavelength; - Impact of items and objects near the antenna depending on the electrical conductivity that is, magnetic permeability of objects and buildings; - Resonant frequency of the antenna; - impedance antenna and adjust to impedance cable; - Orientation and a horizontal, vertical angle of radiation of antenna and others.

Each antenna element of the software breaks down hundreds of segments and each element making calculations, comparison with other segments of the same or neighboring elements and ultimately optimizing. The size, type of material and the location of each element of the antenna is defined in a separate part of the 3D coordinate system. In the past few years, this software updated successfully used for modeling, analysis and optimization of antennas and antenna systems for various purposes such as: - Aerials for radio communications, radio and radio amateurs telecommands; - Antennas for professional FM radio stations; - Aerials for radio taxi companies; - Antennas for professional use in functional systems for radio links in the army and police; - Antennas for Wi-Fi radio links for domestic and professional needs - Antennas for GSM (mobile phones) and so on.

In this particular case, the antenna is dimensioned with the required amplification and suitable angle of radiation to achieve the required coverage area with quality radio signal. Below are pictures of the steps of modeling in antenna software. In this particular case, the antenna is dimensioned with the required amplification and suitable angle of radiation to achieve the required coverage area with quality radio signal. Below are pictures of the steps of modeling in antenna software.
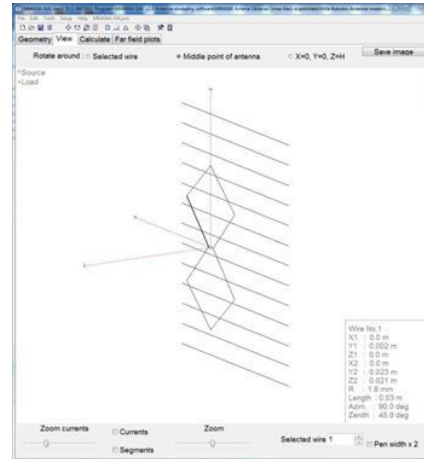
Figure 1. Step 1 of modeling in antenna software
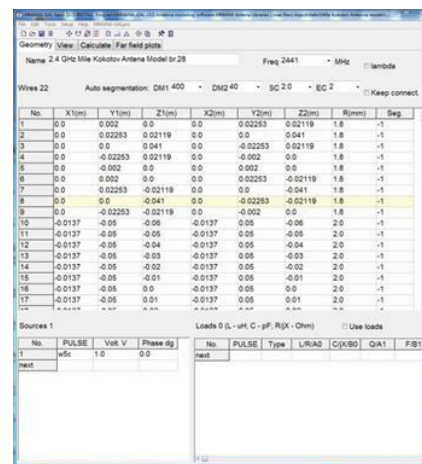
Figure 2. Step 2 of modeling in antenna software

According to the characteristics required of antennas, deciding on which type of antenna you are doing search engine optimization. In this case it requires a directional antenna with a relatively high amplification in order to achieve desired distance. One such type of antenna is "Double Square with Projector area" which gives directed radiation of ENTEL. Then manually entered all the elements of the antenna: If you need to edit each of the elements. Then do initial testing of the antenna depending on the frequency and gives a rough estimate that the antenna has approximately the desired characteristics. After make "fine-tuning" or optimization of the antenna elements. This makes software and requires considerable processing power of the computer.
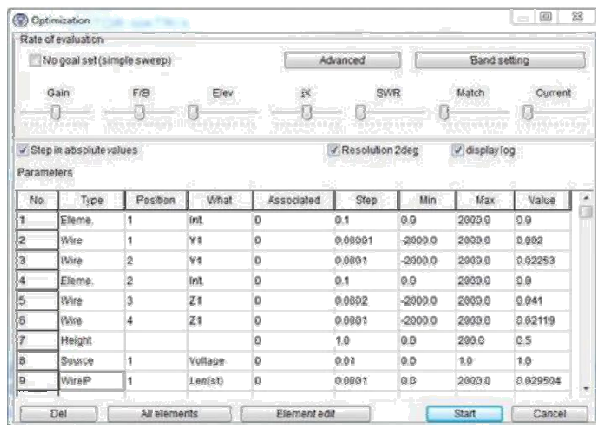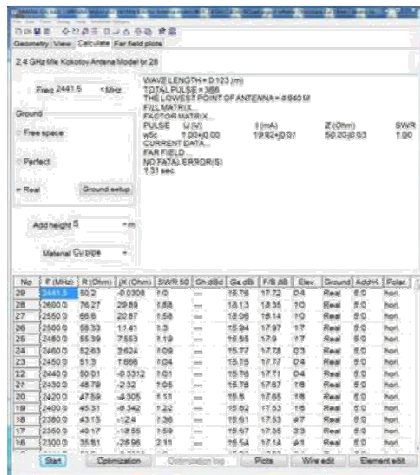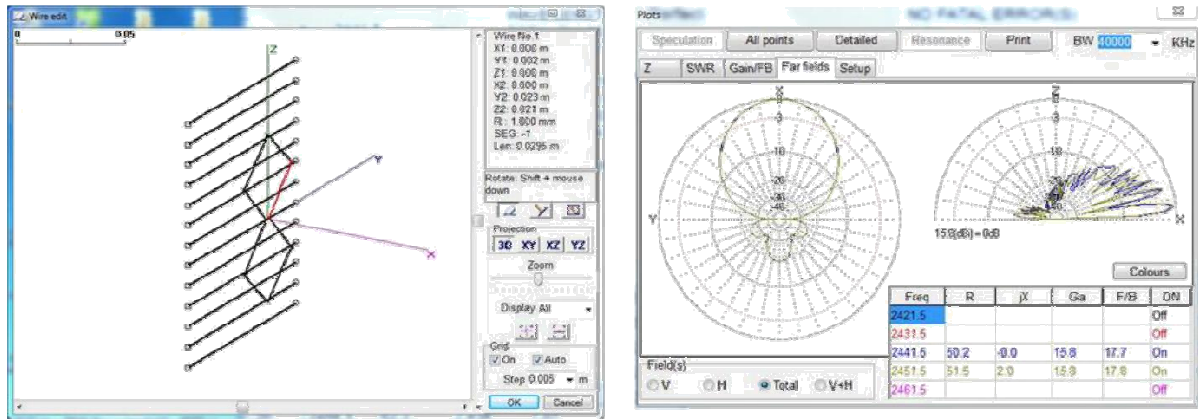
Figure 3. Steps 3 of modeling in antenna software
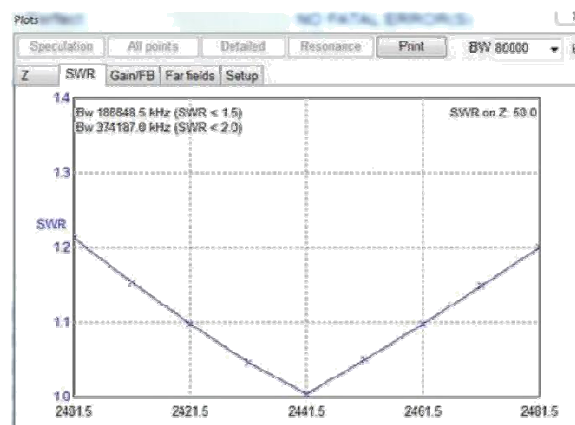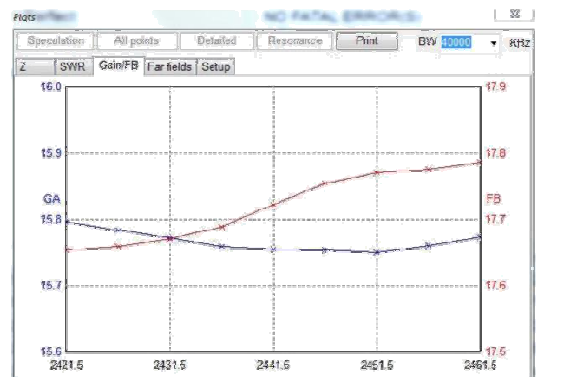
Figure 4. Steps 4 of modeling in antenna software
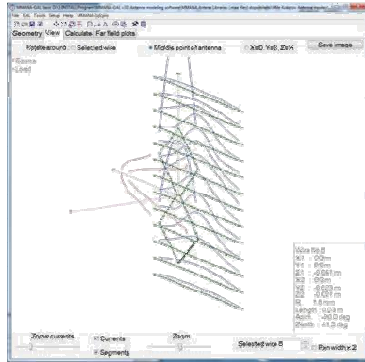
Figure 5. Scheme of Model and radiation angle

Then check diagram of focus, i.e., the horizontal and vertical angle of radiation. Define the operating frequency and maximum limit standing waves (adjustment antenna to cable or etc. SWR). Then examine and optimize the amplification ratio and forward / back, then checked customization of the antenna depending on the frequency, to impedance cable and the device (or Wi-Fi routers), which is 50 ohms. Checking the real ohmic resistance and complex capacitive and inductive resistance of the antenna in relation to the working frequency, control is made high frequency RF currents through the antenna elements. Model and radiation angle of elevation of the main radiation beam antenna in relation to the height of the antenna is set above the ground (previously in the software defines the type of land and its electrical conductivity and permeability). Finally check radiation and antenna orientation in 3D space.
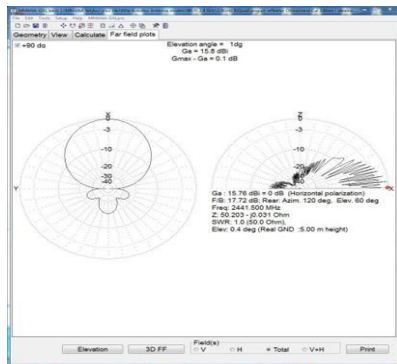
Figure 6. Scheme of Finally check radiation and antenna orientation

III. CONCLUSION

Once MMANA-software for mathematical modeling and analysis of antennas, construct and optimize the appropriate model for antennas to be meet criteria necessary for achieving quality radio link is done making antennas with dimensions optimized in software. Of great importance is the precision, because the frequency is relatively high (2440 MHz), the wavelength is 122 mm, so care must be taken elements of the antenna to be most accurate to ± 0,5 mm in relation to the dimensions obtained from the model in software.

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Analysis of Students' Knowledge for the Topic "Integral"

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Abstract - In this paper will be analyzed and compared the results of the electronic testing (e-testing) for the subject Mathematics 2 within University "Goce Delcev"– Stip using statistical data processing. Electronic testing covers the topic "Integral". This topic is of great importance during the studies and for this topic students have previous knowledge from high school. Testing was conducted on two separated groups of students from technical faculties who have studied this subject in Stip and Kavadarci respectively. The questions were aimed at recognizing the integral as indefinite, definite or improper, as well as, at selecting the method of integration and application of integration in geometry.

Figure 1 Square grid

I. INTRODUCTION

We live in a world where Mathematics is all over around us, and also presents a base of any natural science. Without mathematical knowledge we can't explain some complex physical and natural phenomena, or solve complex problems of daily life. Mathematics as a subject has been taught from primary school and during years, basic gained knowledge is more and more improved. Mathematics as science field is extensive and covers many topics. The aim of our research is the topic Integral.

In the early period of its development mathematics mainly had dealt with geometric problems, primarily problems related with measurement of surfaces [1], [2]. At that time mathematicians only knew how to calculate surface area of a rectangle and a triangle, but there was a problem in calculating the surface area of a circle. Ancient mathematicians had noticed that the area is measured with a single measure that can be compared. Namely, if we agree that the square with side 1 mm has surface area 1 mm^2, then we can determine the surface area of a circle (or any other figure) with appropriate square grid and count the squares covered inside. Of course, as much as network is smaller, the accuracy is greater (Fig. 1).
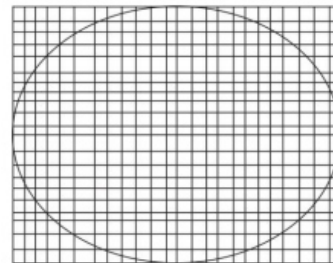
II. INTEGRALS

Simplest case is when the surface is limited by the curve $y = f(x)$, lines $x = a, x = b$ and the x-axis. This surface can be calculated by covering with a mesh of rectangles. For that purpose, we separate the interval $[a,b]$ on n parts with points $a = x_0 < x_1 < x_2 < ... < x_n = b$ and from each of those subintervals we choose only one point $\xi_i \in [x_i, x_{i+1}], i = 0,1,...,n-1$. These points x_i and ξ_i defines a separation of the segment, denote with d.

Let the function $y = f(x)$ is positive and we are considering a rectangles with sides $x_{i+1} - x_i$ and $f(\xi_i)$. The surface area of that rectangle is $f(\xi_i)*(x_{i+1} - x_i)$. The sum of all rectangles is named integral sum of the function $y = f(x)$ on interval $[a,b]$ during the division d:

$$S(f,d,a,b) = \sum_{i=0}^{n-1} f(\xi_i)*(x_{i+1} - x_i).$$

Let $f(x)$ be a function defined on the interval $[a,b]$. If there is definitive limes, independent of division d, on interval $[a,b]$,

$$\lim_{\|d\|\to 0} S(f,d,a,b) = \lim_{\|d\|\to 0} \sum_{i=0}^{n-1} f(\xi_i)*(x_{i+1}-x_i) = I$$

i.e. if $(\forall \varepsilon > 0)(\exists \delta > 0)(\forall d)\|d\| < \delta \Rightarrow$

$|S(f,d,a,b)-I| < \varepsilon$, then for the real number I we can say that is definite integral or Riemann integral of the function f on $[a,b]$, and we can denote $I = \int_a^b f(x)dx$. For the function for which there is a definite integral on $[a,b]$ we can say that is integrabile on $[a,b]$. The numbers a and b are limits of the integral. The procedure for finding the integral is named integration, and the function $f(x)$ is subintegrand function.

Let f be a function defined on the interval (a,b). If there is a function F, with options for each $F'(x) = f(x)$, then the F is called primitive function of f on (a,b). Let F e arbitrary primitive function of f on (a,b). Indefinite integral of the function f, denoted by $\int f(x)dx$, is $\int f(x)dx = F(x)+C$ (where C is constant of integration). Therefore, this concept may be understood as set of all primitive functions of f.

Let the function f is defined on interval $[a,+\infty)$ and is an integral function of any finite interval $[a,b]$. If $\lim_{b\to\infty} \int_a^b f(x)dx$ exists, then this value is defined as improper integral of function f on interval $[a,+\infty)$. Therefore,

$$\int_a^{+\infty} f(x)dx \overset{def.}{=} \lim_{b\to\infty} \int_a^b f(x)dx = \lim_{b\to\infty} F(b) - F(a)$$

where F is arbitrary primitive function of f.

Basic methods of integrating are: method of direct integration, method of decomposition, method of integration by parts (partial integration) and method of replacement.

Students get to know the topic Integral during the high school and when they are enrolling in college they have some basic knowledge about it. Also they learn this topic in the first year of their studies at the Faculty of Computer Science and at the Faculty of Natural and Technical Sciences in subject named Mathematics 2.

III. RESEARCH AND RESULTS

The aim of our research is using electronic testing to analyze students in Stip and Kavadarci to determine whether and how much is their previous knowledge of the subject Integral. The topic of e-test includes questions about the type of integral, methods of integration and application of integration in geometry. The questions were grouped into three categories: questions with choice, true / false and matching.

Testing was conducted in February this year (2016) on Moodle - platform for e-learning and consisted of 9 questions. The time given for answer these questions was 15 minutes and the total number of points that can be gained was 90. It is also important to note that the test was conducted at the beginning of the semester before the classes start. Research and analysis were conducted on 48 students in Stip and Kavadarci and the following results were obtained.

The total number of students in Stip who learned Mathematics 2 and were involved in testing is 25. From 90 - the maximum number of points that can be gained, we can see that the mean obtained is 40.67 i.e. very low. Satisfactory results are results with mean at least 56 or 60% of the total number of points. The maximum number of gained points is 66.7 points and only one student has 66.7 points, while the minimum number of gained points is 23.3. Six students have achieved a 23.3 points. Most of the students or 36% of them have gained 40 to 50 points. These results are shown in Table 1 and Table 2.

Table 1 Descriptive Statistics (Stip)

Descriptive Statistics (Spreadsheet2)				
Variable	Valid N	Mean	Minimum	Maximum	Std.Dev.
Stip	25	40,67200	23,30000	66,70000	11,71810

Table 2 Frequency table (Stip)

	Frequency table: Stip (Spreadsheet2) K-S d=,10873, p> .20; Lilliefors p> .20					
Category	Count	Cumulative Count	Percent of Valid	Cumul % of Valid	% of all Cases	Cumulative % of All
10,00000<x<=20,00000	0	0	0,00000	0,0000	0,00000	0,0000
20,00000<x<=30,00000	6	6	24,00000	24,0000	24,00000	24,0000
30,00000<x<=40,00000	6	12	24,00000	48,0000	24,00000	48,0000
40,00000<x<=50,00000	9	21	36,00000	84,0000	36,00000	84,0000
50,00000<x<=60,00000	3	24	12,00000	96,0000	12,00000	96,0000
60,00000<x<=70,00000	1	25	4,00000	100,0000	4,00000	100,0000
Missing	0	25	0,00000		0,00000	100,0000

In Kavadarci there are 23 students who learned the subject Mathematics 2 and were involved in e-testing. Here the mean is 39.56 from 90 i.e. as in Stip we can say that the main value is very low. The maximum number of gained points is 63.3 and is less than the maximum number of gained points in Stip, also the minimum number of gained points 16.7 is less than the minimum number of gained points in Stip. From this we can conclude that students in Stip have higher previous knowledge than students in Kavadarci. Most of the students or 39.13% of them have gained between 30 and 40 points, and only two students have gained over than 60 points. Results for Kavadarci are shown in Table 3 and Table 4.

Table 3 Descriptive Statistics (Kavadarci)

Descriptive Statistics (Spreadsheet3)				
Variable	Valid N	Mean	Minimum	Maximum	Std.Dev.
Kavadarci	23	39,56087	16,70000	63,30000	12,47710

Table 4 Frequency table (Kavadarci)

Frequency table: Kavadarci (Spreadsheet3) K-S d=,09466, p> .20; Lilliefors p> .20						
Category	Count	Cumulative Count	Percent of Valid	Cumul % of Valid	% of all Cases	Cumulative % of All
10,00000<x<=20,00000	2	2	8,69565	8,6957	8,69565	8,6957
20,00000<x<=30,00000	3	5	13,04348	21,7391	13,04348	21,7391
30,00000<x<=40,00000	9	14	39,13043	60,8696	39,13043	60,8696
40,00000<x<=50,00000	6	20	26,08696	86,9565	26,08696	86,9565
50,00000<x<=60,00000	1	21	4,34783	91,3043	4,34783	91,3043
60,00000<x<=70,00000	2	23	8,69565	100,0000	8,69565	100,0000
Missing	0	23	0,00000		0,00000	100,0000

Figure 3 Overall number of students achieving grade ranges (Kavadarci)

In Fig. 1 is shown a histogram aimed for students from Stip. This histogram gives us a clear view of the points gained from testing. We can also say that the histogram is good because in the middle in the range from 30 to 50 points we have some solid results and we don't have students with less than 20 points, but on the other side is not so good because we don't have students with 80 or 90 points.

Figure 2 Overall number of students achieving grade ranges (Stip)

From the histogram aimed for Kavadarci (shown in Fig. 3) we see that again these is a symmetrical histogram because in the middle in the range from 30 to 50 points the results are pretty good, but here the number of students with less than 40 points is greater compared to Stip (14 students from 23) and we have two students with less than 20 points. And unfortunately this histogram shows that just as in Stip and here we don't have students with more than 70 points.

Fig. 4 and Fig. 5 represent the curve points per student. The first curve (Fig. 4) is for Stip and the second one (Fig. 5) is for Kavadarci, respectively. From the curves we can see that only a few students are better and have more than 45 points out of 90 points or that only this few students have won over than 50% out of 100%.
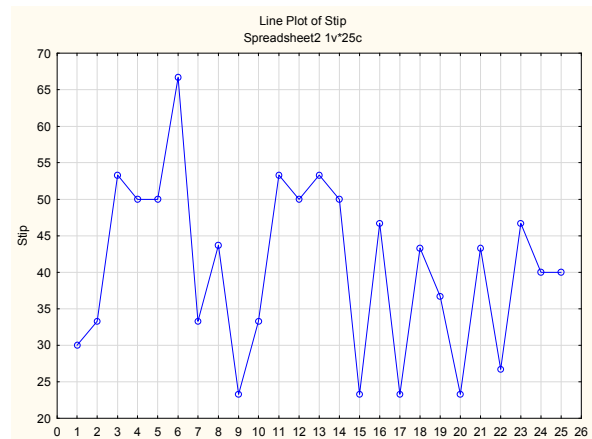
Figure 4 Curve points per student (Stip)
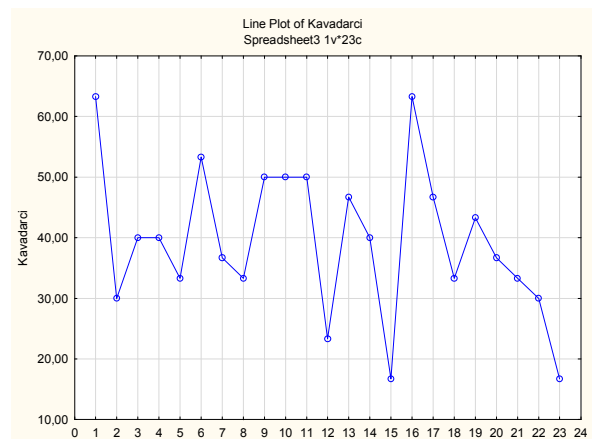
Figure 5 Curve points per student (Kavadarci)

Table 5 shows the overall average points out of 90 and the average points received for each question

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individually. Of a possible 10 points per question we have received up to 5.6 average points, which means that there is no question which correct answer are known by all students. And from the table we can also can see that the question 7 at least known question by students. These points are related to the overall results obtained from e-testing conducted in Stip and Kavadarci.

Table 5 Overall average

Points /90	Q1 /10	Q2 /10	Q3 /10	Q4 /10	Q5 /10	Q6 /10	Q7 /10	Q8 /10	Q9 /10
40,2	5,4	4,8	5,6	5,3	4,9	4,2	2,8	3,3	3,9

IV. DISCUSSION AND CONCLUSION

From conducted research we can conclude that all students (without any matter from what high school they are coming - basic or professional) have a little knowledge of Mathematics, in particular for the topic Integral. We concluded this from analyzes for Stip and Kavadarci, and the fact that the overall average number of points obtained out of 90 is only 40.2 points. The average value per question is in range from minimum 2.8 to maximum 5.6 points out of 10 which is also a small percentage.

Our next goal is to make a comparison of these results which shows the previous knowledge of students with the results obtained after the study of the topic i.e. the results obtained after the implementation of a colloquium. Also, this research can be extended to a large number of tested students. Actually, in this e-test may be included students of second and third cycle of studies that have learned Mathematics 2 during previous studies. Then we will compare the previous results with the results obtained of the examination of a large number of respondents. Comparison will bring a conclusion about which results are better, whether the future generations have more previous knowledge or not, and so on.

Our personal conclusion that we got by analyzing the results of the e-test is that students have to show greater interest in Mathematics, because Mathematics is the base of all other sciences and its application is extended in every life field.

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Wavelets and Continuous Wavelet Transform

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Abstract - The concepts of wavelet theory were provided by Meyer, Mallat, Daubechies and many others. Wavelets are well localized, oscillatory functions which provide a basis of $L^2(\mathbb{R})$ and can be modified to a basis of $L^2([a,b])$, where $[a,b]$ is a bounded domain. Wavelet transform or wavelet analysis is a recently developed mathematical tool for signal analysis. In this paper are shown some relation for the wavelet transform and using Wolfram Mathematica 10 is given the wavelet transform of the signal $f(x) = \sin x$. A prove that multiplication of real number with wavelet and sum of two wavelets are wavelets is also provided.

I. INTRODUCTION

Wavelets have been around since the late 1980s, and have found many applications in signal processing, numerical analysis, operator theory, and other fields [2, 5, and 10]. In 1982, the French geophysicist Jean Morlet introduced the concept of a "wavelet", which means a small wave and studied wavelet transform as a new tool for seismic signal analysis [1, 12]. The wavelet transform is a tool that cuts up data or functions or operators into different frequency components, and then studies each component with a resolution matched to its scale. The concepts of wavelet theory were provided by Meyer, Mallat, Daubechies and many others, [3,4,6,7,8,12,15]. Wavelets are well localized, oscillatory functions which provide a basis of $L^2(\mathbb{R})$ and can be modified to a basis of $L^2([a,b])$ where $[a,b]$ is a bounded domain [8,9]. Their well

$L^2(\mathbb{R})$ is a Hilbert space of square integral functions on the real line with the inner product

$$\langle f, g \rangle = \int_{\mathbb{R}} f(t)\overline{g}(t) dt \qquad (1)$$

where $\overline{g}(t)$ is a complex conjugate of $g(t)$. The Fourier transform of a function $f \in L^2(\mathbb{R})$ is given with

$$\hat{f}(\omega) = \int_{-\infty}^{\infty} f(t)e^{-i\omega t} dt.$$

$C^2([a,b])$ is the space of functions on $[a,b]$, $\forall\, a,b \in R$ with continuous derivatives up to order

localization allows local variations of the problem to be analyzed at various levels of resolution.

Wavelets have generated significant interest from both theoretical and applied researchers over the last few decades. In areas such as time-series analysis, approximation theory and numerical solutions of differential equations, wavelets are recognized as powerful weapons not just tools. In [13] is found the approximate solution in different levels of the Laplace partial differential equation of third order using the Wavelet-Galerkin method. But in [11, 14] the same method is used to solve differential equation for a different wavelets.

The outline of this paper is as follows: In Section II we describe the spaces of functions and we define wavelets, translation and modulation of a function and wavelet transform. In Section III are shown some relations for the wavelet transform and using Wolfram Mathematica 10 is given the wavelet transform of the signal $f(x) = \sin x$. A prove that multiplication of real number with wavelet and sum of two wavelets are wavelets is also provided.

II. WAVELETS AND CONTINUOUS WAVELET TRANSFORM

A. Spaces of functions

2. The convolution of two integral functions i.e. $f, g \in L^1(R)$ is defined as

$$(f * g)(x) = \int_R f(y)g(x-y) dy.$$

B. Wavelets

A function $\psi \in L^2(\mathbb{R})$ is called a wavelet if it has zero average on $(-\infty, +\infty)$ i.e.

$$\int_{-\infty}^{+\infty} \psi(t) dt = 0. \qquad (2)$$

The function $\psi \in L^2(\mathrm{R})$ (called a *wavelet* or *mother wavelet*) is assumed to satisfy the admissibility condition

$$C_\psi = \int_{-\infty}^{\infty} \frac{|\hat{\psi}(\omega)|^2}{|\omega|} d\omega < \infty, \qquad (3)$$

which implies that $\hat{\psi}(0) = \int_{-\infty}^{\infty} \psi(t)dt = 0$.

One can prove that, if $\int_{-\infty}^{\infty} \psi(t)dt = 0$ and $\int_{-\infty}^{\infty} (1+|t|^\alpha)|\psi(t)|dt < \infty$ for some $\alpha > 0$, then $C_\psi < \infty$, [9].

Remark1. Let us note that there is no classical definition for wavelets. Sometimes functions that satisfy the admissibility condition (3) are called wavelets, but usually functions that satisfy the condition that gives the first vanishing moment (2) are called wavelets.

In most situations, it is usefully to restrict ψ to be well localized both in time and frequency domains. For time localization, $\psi(t)$ and its derivatives must decay very rapidly, while for frequency localization, $\hat{\psi}(\omega)$ must decay sufficiently fast as $|\omega| \to \infty$ and $\hat{\psi}(\omega)$ must become a flat in the neighborhood of 0. The flatness is associated with the number of vanishing moments of $\psi(t)$ since $\int_{-\infty}^{\infty} t^k \psi(t)dt = 0 \Leftrightarrow \hat{\psi}^{(k)}(0) = 0$ for $k = 0, 1,$ …, n. It means that larger number of vanishing moments more is the flatness ω is small.

Lemma 1. ([1], Lemma 10.2.1) Let $\varphi(t)$ be a nonzero n-times ($n \geq 1$) differentiable functions such that $\varphi^{(n)}(x) \in L^2(R)$. Then $\psi(x) = \varphi^{(n)}(x)$ is a wavelet.

Corollary 2. ([1], Corollary 10.2.1) For every non-zero element $\psi(x) \in L^2(R)$ with compact support, the following statements are equivalent:

1. The function $\psi(t)$ is a wavelet
2. The condition (3) is satisfied.

Theorem 3. ([1], Theorem 10.2.1) Let ψ be a wavelet and φ a bounded integral function then the convolution $\psi * \varphi$ is a wavelet.

Example1. (Haar Wavelet) Let

$$\psi(x) = \begin{cases} 1, & 0 \leq x < \frac{1}{2} \\ -1, & \frac{1}{2} \leq x \leq 1 \\ 0, & x < 0 \text{ or } x > 1 \end{cases} \qquad (4)$$

It is clear that $\psi(x)$ has compact support $[0,1]$ and $\int_R \psi(x)dx = \int_0^{1/2} dx - \int_{1/2}^1 dx = 0$.
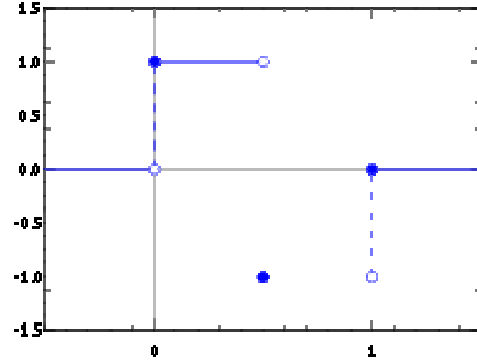
Figure 1. Haar Wavelet

The Fourier transform is

$$\hat{\psi}(\omega) = \frac{1}{\sqrt{2\pi}} \int_o^{1/2} e^{-i\omega x} dx - \frac{1}{\sqrt{2\pi}} \int_{1/2}^1 e^{-i\omega x} dx$$

$$= \frac{1}{i\omega\sqrt{2\pi}} \left(-2e^{-i\omega/2} + 1 + e^{-i\omega}\right)$$

$$= \frac{1}{i\omega\sqrt{2\pi}} \left(1 - e^{-i\omega/2}\right)^2$$

$$= \frac{1}{i\omega\sqrt{2\pi}} \left(\frac{e^{i\omega/2} - 1}{e^{i\omega/2}}\right)^2 \cdot \frac{1}{\left(2ie^{i\omega/4}\right)^2} \cdot \left(2ie^{i\omega/4}\right)^2$$

$$= \frac{1}{i\omega\sqrt{2\pi}} \left(\frac{e^{i\omega/2} - 1}{2ie^{i\omega/4}}\right)^2 \cdot \frac{1}{\left(e^{i\omega/2}\right)^2} \cdot \left(2ie^{i\omega/4}\right)^2$$

$$= -\frac{1}{i\sqrt{2\pi}} \frac{\left(\sin\frac{\omega}{4}\right)^2}{\frac{\omega}{4}} e^{-\frac{i\omega}{2}} e^{\frac{i\pi}{2}} = \frac{1}{\sqrt{2\pi}} \frac{\left(\sin\frac{\omega}{4}\right)^2}{\frac{\omega}{4}} e^{-\frac{i}{2}(\omega-\pi)}.$$

Function (4) satisfies the condition (2) and also the admissibility condition (3), so by the Corollary 2 is a wavelet (see Figure 1).

Example 2. (Mexican Hat Wavelet) The function defined as

$$\psi(x) = \left(1 - x^2\right) e^{-\frac{x^2}{2}} \qquad (5)$$

may be written as second derivative of non-zero n-times ($n \geq 1$) differentiable function $\varphi(x) = e^{-\frac{x^2}{2}}$ such that $\varphi^{(2)}(x) \in L^2(R)$ i.e.

$$\psi(x) = -\frac{d^2}{dx^2} e^{-\frac{x^2}{2}} = (1 - x^2) e^{-\frac{x^2}{2}}.$$

According to Lemma 1 the function (5) is a wavelet and even more it is known as the Maxican hat wavelet (Figure 2). From Figure 1 and Figure 2 we can note that the Haar wavelet is discontinuous at $x = 0, \frac{1}{2}, 1$ but the Maxican hat wavelet is a continuous on R.
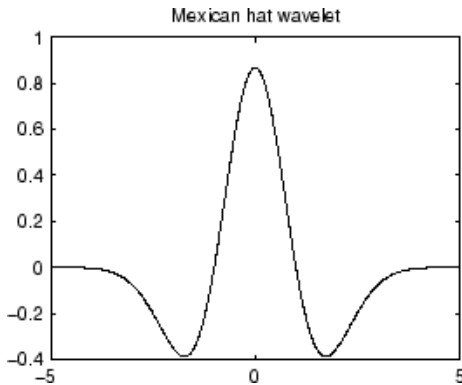
Figure 2. Mexican hat wavelet

Example 3. The convolution of the Haar wavelet and the function $\varphi(x) = e^{-x^2}$, is the function on the Figure 3. According to Theorem 3 this function is a wavelet.
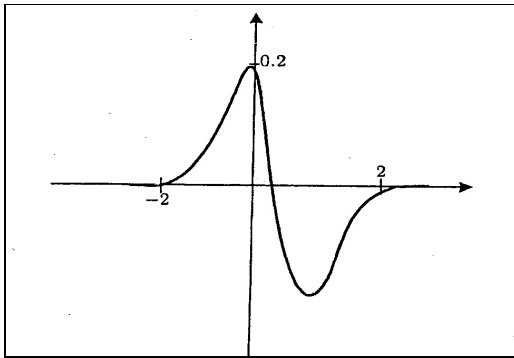
Figure 3. Convolution of the Haar wavelet and $\varphi(x) = e^{-x^2}$

C. Basic operations

Let $x \in R$, $a \in R$, $a \neq 0$. With (6) and (7) are given the translation operator and the dilatation operator, respectively

$$T_x f(t) = f(t - x) \tag{6}$$

$$D_a f(x) = |a|^{-1/2} f(a^{-1} x). \tag{7}$$

Translation operator T_x retains the form of the function but slip feature along the x-axis depending on the parameter x (see Figure 4). Dilatation operator D_a preserve the form of the function, but it change the scale i.e. "width" of the function (see Figure 5 a) and b) by different factor).
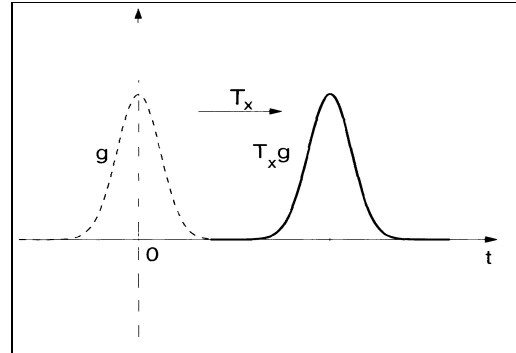
Figure 4. Translated function
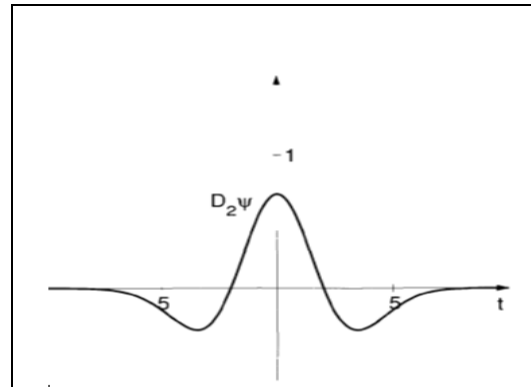
a)
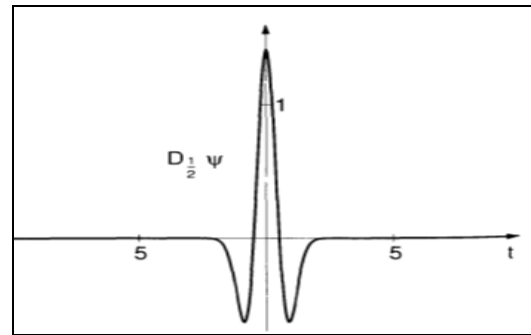
b)

Figure 5. Dilatation of the function a) by factor 2 b) by factor 1/2

D. The continuous wavelet transform

The continuous wavelet transform W_ψ of a function $f \in L^2(R)$ with respect to the wavelet ψ is defined as

$$W_\psi f(a,b) = |a|^{-1/2} \int_R f(t) \overline{\psi}\left(\frac{t-b}{a}\right) dt \qquad (8)$$

where $a \in R \setminus \{0\}$, $b \in R$ and $\overline{\psi}$ denotes complex conjugate. Let ψ is a wavelet (mother wavelet) then $\{\psi_{a,b}\}$ is a family of functions defined as

$$\psi_{a,b}(t) = |a|^{-1/2} \psi\left(\frac{t-b}{a}\right), a \in R \setminus \{0\}, b \in R. \qquad (9)$$

Wavelet transform can be written in other forms, such as

$$W_\psi f(a,b) = <f, \psi_{a,b}>$$
$$= <f, T_b D_a \psi>.$$

using (1), (6), (7) and (8). It may be observe that wavelet transform $W_\psi f(b,a)$ is a function of scale or frequency a and time b. $W_\psi f(b,a)$ measures the variation of f in a neighborhood of b. For a compactly supported wavelet, the value of $W_\psi f(b,a)$ depends upon the value of f in a neighborhood of b of size proportional to scale a. If $\text{supp}\,\psi \subseteq E$ and the set E is centered around the origin then $\text{supp}\,T_b D_a \psi \subseteq b + aE$ is a neighborhood of b with scale a. On the Figure 7 is given the signal with four frequencies (a) and its wavelet transform (b).
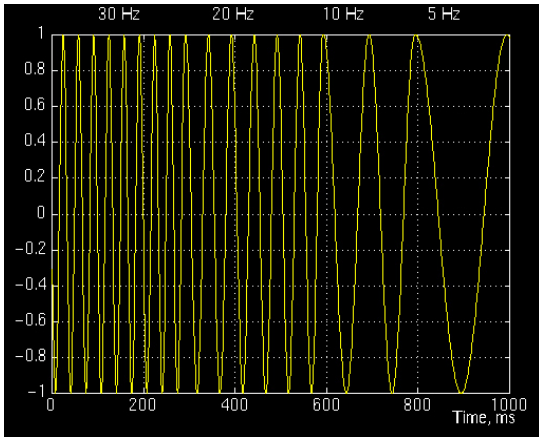
a)
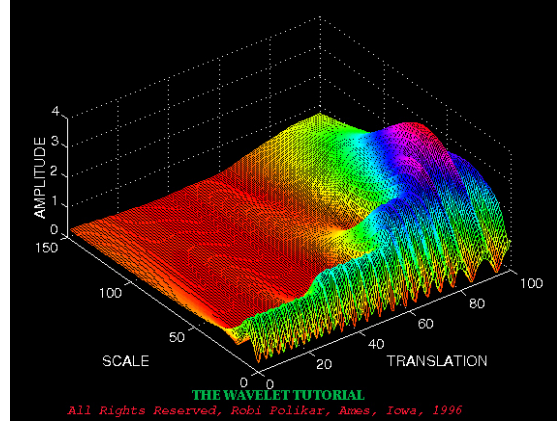
b)

Figure 7. a) Signal with four frequencies b) Wavelet transform of the signal

III. MAIN RESULTS

In this section are shown two properties for wavelets, some useful relations for the wavelet transform and using Wolfram Mathematica 10 is given the wavelet transform of the signal $f(x) = \sin x$.

Problem 1. If $\psi_1(x)$ and $\psi_2(x)$ are two wavelets then for $a \in R$, $a\psi_1(x)$ and $\psi_1(x) + \psi_2(x)$ are wavelets.

Proof:

a) $\psi_1(x)$ and $\psi_2(x)$ are wavelets so they have zero-average on $(-\infty, \infty)$, i.e. $\int_{-\infty}^{+\infty} \psi_1(t)dt = 0$, $\int_{-\infty}^{+\infty} \psi_2(t)dt = 0$.

Using this and the additivity of the integral we have

$$\int_{-\infty}^{+\infty} (\psi_1 + \psi_2)(t)dt = \int_{-\infty}^{+\infty} \psi_1(t)dt + \int_{-\infty}^{+\infty} \psi_2(t)dt = 0$$

and $\int_{-\infty}^{+\infty} \alpha\psi_1(t)dt = \alpha\int_{-\infty}^{+\infty} \psi_1(t)dt = 0$.

According to (2) we can conclude that $\psi_1(x) + \psi_2(x)$ and $a\psi_1(x)$ are wavelets.

b) If we assume that $\psi_1(x)$ and $\psi_2(x)$ are wavelets with compact support, using the collorary 2 they satisfy the condition (3) so the Fourier transform for $\psi(x) = \psi_1(x) + \psi_2(x)$ is

$$\hat{\psi}(\omega) = \int_{-\infty}^{+\infty} \psi(t)e^{-2\pi i \omega t}dt = \hat{\psi}_1(\omega) + \hat{\psi}_2(\omega).$$

$$C_\psi = \int_{-\infty}^{\infty} \frac{|\hat{\psi}(\omega)|^2}{|\omega|} d\omega = \int_{-\infty}^{\infty} \frac{|\hat{\psi}_1(\omega) + \hat{\psi}_2(\omega)|^2}{|\omega|} d\omega =$$

$$= \int_{-\infty}^{\infty} \frac{|\hat{\psi}_1(\omega)|^2}{|\omega|} d\omega + \int_{-\infty}^{\infty} \frac{2|\hat{\psi}_1(\omega)||\hat{\psi}_2(\omega)|}{|\omega|} d\omega + \int_{-\infty}^{\infty} \frac{|\hat{\psi}_2(\omega)|^2}{|\omega|} d\omega$$

$$\leq \int_{-\infty}^{\infty} \frac{\left|\hat{\psi}_1(\omega)\right|^2}{|\omega|} d\omega + \int_{-\infty}^{\infty} \frac{\left|\hat{\psi}_2(\omega)\right|^2}{|\omega|} d\omega +$$

$$+ \int_{-\infty}^{\infty} \frac{2 \int_{-\infty}^{\infty}\left|\psi_1(\omega)e^{-2\pi i \omega t}\right| dt \int_{-\infty}^{\infty}\left|\psi_2(\omega)e^{-2\pi i \omega t}\right| dt}{|\omega|} d\omega < \infty$$

$$C_\psi = \int_{-\infty}^{\infty} \frac{\left|\alpha\hat{\psi}_1(\omega)\right|^2}{|\omega|} d\omega = \alpha^2 \int_{-\infty}^{\infty} \frac{\left|\hat{\psi}_1(\omega)\right|^2}{|\omega|} d\omega < \infty$$

Function $\psi(x)$ and $\alpha\psi_1(x)$ satisfied the admissibility condition (3), so by collorary 2 $\psi_1(x) + \psi_2(x)$ and $a\psi_1(x)$ are wavelets.

Problem 2. Let ψ and ϕ are wavelets and let $f, g \in L^2(R)$, for $\forall \alpha, \beta \in C$. Prove the relations:

a) $W_\psi(\alpha f + \beta g)(a,b) = \alpha W_\psi f(a,b) + \beta W_\psi g(a,b)$,

$$W_\psi(\alpha f + \beta g)(a,b) = |a|^{-1/2} \int_R (\alpha f + \beta g)(t) \overline{\psi}\left(\frac{t-b}{a}\right) dt$$

$$= \alpha |a|^{-1/2} \int_R f(t) \overline{\psi}\left(\frac{t-b}{a}\right) dt +$$

$$+ \beta |a|^{-1/2} \int_R g(t) \overline{\psi}\left(\frac{t-b}{a}\right) dt$$

$$= \alpha W_\psi f(a,b) + \beta W_\psi g(a,b)$$

b) $W_\psi(T_x f)(a,b) = W_\psi f(a,b-x)$, $c \in R$.

$$W_\psi(T_x f)(a,b) = |a|^{-1/2} \int_R f(t-x) \overline{\psi}\left(\frac{t-b}{a}\right) dt$$

$$= |a|^{-1/2} \int_R f(m) \overline{\psi}\left(\frac{m-(-x+b)}{a}\right) dm$$

$$= W_\psi f(a,b-x)$$

c) $W_\psi(D_s f)(a,b) = W_\psi f(a/s, b/s)$, $s > 0$.

$$W_\psi(D_s f)(a,b) = |a|^{-1/2} \int_R |s|^{-1/2} f(s^{-1}t) \overline{\psi}\left(\frac{t-b}{a}\right) dt$$

$$= |a|^{-1/2} \int_R f(m) \overline{\psi}\left(\frac{m-(b/s)}{a/s}\right) dm$$

$$= W_\psi f(a/s, b/s)$$

d) $W_\psi f(a,b) = W_f \psi(1/a, -b/a)$, $a \neq 0$.

$$W_\psi f(a,b) = |a|^{-1/2} \int_R f(t) \overline{\psi}\left(\frac{t-b}{a}\right) dt$$

$$= |a|^{-1/2} \int_R \bar{f}\left(\frac{z+(b/a)}{1/a}\right) \psi(z) a dz$$

$$= W_f \psi(1/a, -b/a)$$

e) $W_{\alpha\psi+\beta\phi} f(a,b) = \bar{\alpha} W_\psi f(a,b) + \bar{\beta} W_\phi f(a,b)$,

$$W_{\alpha\psi+\beta\varphi} f(a,b) = |a|^{-1/2} \int_R f(t) \overline{(\alpha\psi+\beta\varphi)}\left(\frac{t-b}{a}\right) dt$$

$$= |a|^{-1/2} \int_R f(t) \overline{\alpha\psi}\left(\frac{t-b}{a}\right) dt$$

$$+ |a|^{-1/2} \int_R f(t) \overline{\beta\varphi}\left(\frac{t-b}{a}\right) dt$$

$$= \bar{\alpha} W_\psi f(a,b) + \bar{\beta} W_\varphi f(a,b)$$

f) $W_{T_x\psi} f(a,b) = W_\psi f(a,b+xa)$, $x \in R$.

$$W_{T_x\psi} f(a,b) = |a|^{-1/2} \int_R f(t) \overline{T_x\psi}\left(\frac{t-b}{a}\right) dt$$

$$= |a|^{-1/2} \int_R f(t) \overline{\psi}\left(\frac{t-b}{a} - x\right) dt$$

$$= |a|^{-1/2} \int_R f(t) \overline{\psi}\left(\frac{t-(b+ax)}{a}\right) dt$$

$$= W_\psi f(a,b+xa)$$

g) $W_{D_x\psi} f(a,b) = 1/\sqrt{x} \, W_\psi f(ac,b)$, $x > 0$.

$$W_{D_x\psi} f(a,b) = |a|^{-1/2} \int_R f(t) \overline{D_x\psi}\left(\frac{t-b}{a}\right) dt$$

$$= |a|^{-1/2} \int_R f(t) |x|^{-1/2} \overline{\psi}\left(x^{-1}\frac{t-b}{a}\right) dt$$

$$= |x|^{-1/2} W_\psi f(ax,b).$$

Problem 3. Compute the wavelet transform of the signal $f(x) = \sin x$ using the Haar wavelet (4). Solution:

$$W_\psi f(a,b) = |a|^{-1/2} \int_R \sin x \, \overline{\psi}(\frac{x-b}{a}) dx =$$

$$= |a|^{-1/2} \left(\int_b^{\frac{a}{2}+b} \sin x \, dx - \int_{\frac{a}{2}+b}^{a+b} \sin x \, dx \right)$$

$$= |a|^{-1/2} \left(\cos b + \cos(a+b) - 2\cos\left(\frac{a}{2}+b\right) \right)$$

On the Figure 9 is given the signal $f(x) = \sin x$ and its wavelet transform that we obtain in Wolfram Mathematica 10 using Haar wavelet.

CONCLUSION

From the problem 1 we can conclude that the sum of two wavelets and multiplication of the real number with a wavelet are also wavelets which are very important properties for the wavelet transform. The relations that are proven in problem 2 simplify the calculation of the wavelet transform over the

sum of functions, multiplication of the real number and function, dilated and translated function; or wavelet transform of the function using sum of wavelets, multiplication of the real number and wavelet, dilated and translated wavelet. In problem 3 we can visually see the wavelet transform of the signal $f(x) = \sin x$, despite the mathematical calculation.

a)

b)
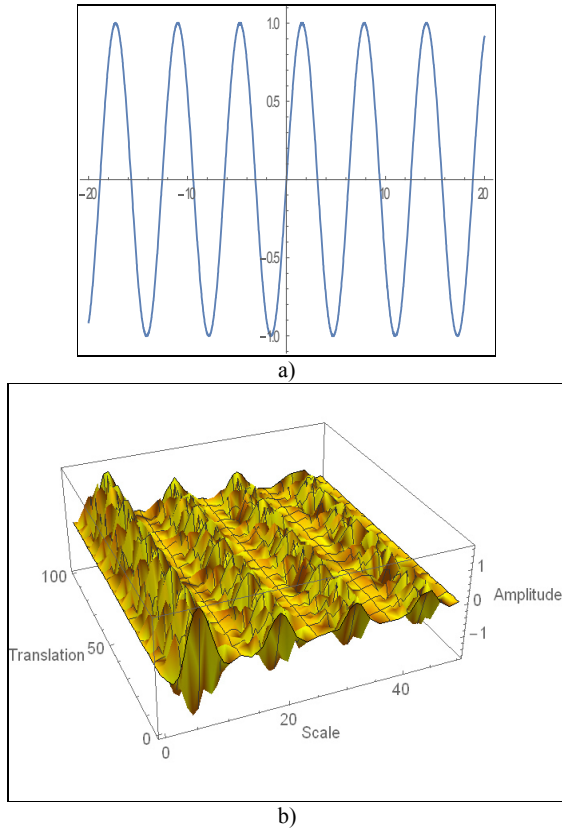
Figure 8. a) Signal $f(x) = \sin x$, b) Wavelet transform of the signal

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Relationship Between the Extremes of a Functional And its Variation

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Abstract - Methods to solve variational problems, the tasks for the study for maximum and minimum of functionals are very similar methods to study the maximum and minimum functions. Therefore, appropriate to outline briefly the theory of maximum and minimum functions and in parallel we will introduce similar concepts and prove similar theorems for functional.

The variation of functional is primary and linear with respect to a part of the increase of functional. In the study of functional, variation plays the same role played by the differential in the study of functions.

We will show that if there is a variation in the basic sense of the linear increase of functional, then there is a variation in the derivative sense of the parameter with initial value, and that both definitions are equivalent and we will give another definition of functional variation. The above we will show in several examples and we will prove a theorem which is a link between the extremes of a functional and its variation.

I.   INTRODUCTION

We will appropriate to outline briefly the theory of maximum and minimum of functions and in parallel we will introduce similar concepts and prove similar theorem for functional.

Definition 1 Variable y is called a function of a variable x which is indicated as follows: $y = f(x)$, where each value x in a particular area changes correspond to y i.e the number x corresponds to the number y.

Definition 2 Image   is called functional. We will consider functional v defined on a multitude of functions and use the designation $v[y(x)]$.

Definition 3 Functional of n variables call an image of each ordered n variables
$$x_1 \in X_1, x_2 \in X_2, \dots, x_n \in X_n$$
where $X = (X_1 \times X_2 \times \dots \times X_n)$, collate single value $F(x_1, x$.

We will consider a special case of functional three variables, when
$$X_1 \equiv R, X_2 \equiv C^1_{[a,b]}, X_3$$
And
$$F = F(x, y, y').$$
Consider space $X = R \times ($ equipped with metrics
$$\rho(x_1, y_1, y_1') = |x_1 - x_2| + \max_x |y_1(x) - y_2(x)| + \max_x |y_1'(x) - y_2'(x)|$$
.

Definition 4 The increase   of the argument x of the function $f(x)$ at the point x_0 is called the difference between the two figures on this variable $\Delta x = x - x_0$.
If x is the independent variable, then the differential of x match with the increase, i.e. $dx = \Delta x$.

Definition 5 Increase or variation δy of the argument $y(x)$ of the functional $v[y(x)]$ in the point $y_0(x)$ is called the difference between the two functions $\delta y = y(x) - y_0(x)$.
The function $y(x)$ varies randomly in a certain class of functions (e.g the class of continuous functions $C_{[a,b]}$ or classes of functions with continuous first derivative $C^{(1)}_{[a,b]}$).
Let's   look   at   the   function
$$F = F(x, y, y', \dots, y^{(k)})$$ and
functional   equal to
$$v[y(x)] = \int_{x_0}^{x_1} F(x, y, y', y'', \dots, y^{(k)}) \, dx.$$
In this connection must be established following definitions   for   the   distance   between the curves $y = y(x)$ and $y = y_1(x)$:

- the curves $y = y(x)$ and $y = y_1(x)$ are the zero order if the distance between them $\max_x |y(x) - y_1(x)|$, if small.

- the curves $y = y(x)$ and $y = y_1(x)$ are the first order if the distance between them $\max_x |y(x) - y_1(x)| + \max_x |y'(x) - y_1'(x)|$, if small.

- the curves $y = y(x)$ and $y = y_1(x)$ are the k-th order if the distance between

$$\max_x |y(x) - y_1(x)|$$

$$+ \max_x |y'(x) - y_1'(x)|$$

them $+ \max_x |y''(x) - y_1''(x)|$

$$\dots\dots\dots\dots$$

$$+ \max_x |y^{(k)}(x) - y_1^{(k)}(x)|$$

is small.

From these definitions, it follows that if the curves are close in terms of distance from the k-th order, they are even close in terms of distance from each-mean order. Now it can clarify the concept of functional continuity.

Definition 6. The functional $v[y(x)]$ is continuous at $y = y_0(x)$ in terms of the distance from the k-th order, if for any positive integer ε exists integer $\delta > 0$ such that $|v[y(x)] - v[y_0(x)]| < \varepsilon$ at

$$\rho_\infty(y, y_0) = \max_x |y(x) - y_0(x)| < \delta,$$

$$\rho_\infty(y', y_0') = \max_x |y'(x) - y_0'(x)| < \delta,$$

$$\rho_\infty(y'', y_0'') = \max_x |y''(x) - y_0''(x)| < \delta,$$

$$\dots\dots\dots\dots\dots\dots\dots$$

$$\rho_\infty(y^{(k)}, y_0^{(k)}) = \max_x |y^{(k)}(x) - y_0^{(k)}(x)| < \delta.$$

This implies that the function $y(x)$ is taken from class of functions, for which the functional $v[y(x)]$ is defined.

Definition 7. A linear functional is called a functional $L[y(x)]$ satisfying the following condition:

$L[cy(x)] = cL[y(x)]$, where c is an arbitrary constant, and

$$L[y_1(x) + y_2(x)] = L[y_1(x)] + L[y_2(x)].$$

An example of a linear functional is $L[y(x)] = \int_{x_0}^{x_1} (p(x)y(x) + q(x)y'(x))\, dx$.

Example 1. Let us consider the functional

$$v[x] = \int_0^1 x(t)\sin\left(\frac{\pi}{2}t\right) dt: C_{[0,1]}^{(1)}$$

and

$$\mu(x) = \int_0^1 (x(t) + x'(t))\sin\left(\frac{\pi}{2}t\right) dt: C_{[0,1]}^{(1)} \to R$$

. The functional

$$\mu(x) = \int_0^1 x(t)\sin\left(\frac{\pi}{2}t\right)dt + \int_0^1 x'(t)\sin\left(\frac{\pi}{2}t\right)dt \quad \text{is}$$

linear and continuous.
Really $v(x + y) = v(x) + v(y)$, $v(\alpha x) = \alpha v(x)$.

$$\left|\int_0^1 y(t)\sin\left(\frac{\pi}{2}t\right)dt - \int_0^1 y_0(t)\sin\left(\frac{\pi}{2}t\right)dt\right| \le \int_0^1 \sin\left(\frac{\pi}{2}t\right)dt|y(t) - y_0(t)|dt \le$$

$$\le \max_{t\in[0,1]}|y(t) - y_0(t)|\int_0^1 \sin\left(\frac{\pi}{2}t\right)dt = \rho_\infty(y, y_0)\frac{2}{\pi}\cos\frac{\pi}{2}t\Big|_0^1 =$$

$$= \rho_\infty(y, y_0)(-\cos\frac{\pi}{2} + \cos 0) = \rho_\infty(x, y)\frac{2}{\pi}$$

Let $\delta = \varepsilon\frac{\pi}{2}$.

Therefore, when y_0 is fixed, for x we receive

$$|y - y_0| < \delta = \varepsilon\frac{\pi}{2} \Rightarrow |f(x) - f(y_0)| < \varepsilon\frac{\pi}{2}\frac{2}{\pi} = \varepsilon,$$

and therefore v is a continuous functional on $\forall x_0 \in [0,1]$.
Similarly we can check that μ is continuous functional.

Example 2.

The functional $v[y(x)] = \int_0^1 y^2(t)\sin\left(\frac{\pi}{2}t\right)dt$, is not linear, but is continuous.

$$v(y) - v(y_0) = v[y(x)] = \int_0^1 \left(y^2 - y_0^2\right)\sin\left(\frac{\pi}{2}t\right)dt =$$

$$= \int_0^1 (y - y_0)(y + y_0)\sin\left(\frac{\pi}{2}t\right)dt \le \max_x |y - y_0| \int_0^1 (y + y_0)\sin\left(\frac{\pi}{2}t\right)dt \le$$

$$\le \max_x |y - y_0| \max_x |y + y_0| \int_0^1 \sin\left(\frac{\pi}{2}t\right)dt$$

Let $\quad M = \max_x |y_0(x)| \quad$ and

$$\delta = \max_x |y(t) + y_0(t)| < 3M \qquad \text{for}$$

$\forall y \in B_{1/2M}(y_0)$.

Indeed, from the inequality $\quad -\delta < y(t) - y_0(t) < \delta, \quad за \ \forall t$,

where $\qquad \delta = \frac{1}{2}M$,

and $\qquad \frac{1}{2}M < y(t) < \frac{3}{2}M, \quad за \ \forall t$

should $|y(t) - y_0(t)| < |y(t)| + |y_0(t)| < 3M$

Then, for $\forall y \in B_{\frac{\pi}{6M}\varepsilon}(y_0)$ we

obtain

$$v(y) - v(y_0) \le \max_x |y - y_0| \max_x |y + y_0| \int_0^1 \sin\left(\frac{\pi}{2}t\right)dt \le \frac{\varepsilon(y + \delta y_2 + \delta y_2)}{6M} \cdot 3M \cdot 2\varepsilon.$$

If the increase of the function $\quad \Delta f = f(x + \quad$ can be represented in the form $\quad \Delta f = A(x)\Delta x + \beta|$ where $A(x)$ is independent of Δx, and $\beta(x, \Delta x) \to 0$ at $\Delta x \to 0$, then the function is called differentiable, and the linear part with respect to the increase Δx, $A(x) \Delta x$ is called a differential of the function and means df. Dividing to Δx and make a border transition at $\Delta x \to 0$, we obtain that

$$\lim_{\Delta x \to 0} \frac{\Delta f}{\Delta x} = A(x) + \lim_{\Delta x \to 0} \rho(x, \Delta x) = A(x) = f'(x)$$

and therefore df=f'(x) Δx.

If the increase of the functional $\quad \Delta v - v[y(x) + \delta y] - \quad$ can be

written as $\quad \Delta v = L[y(x), \delta y] + \beta(y(x), \delta y)\max|\delta y|$ where $\max|\delta y|$ is the maximum value of $|\delta y|$, and $\beta(y(x), \delta y) \to 0$ at $\max|\delta y| \to 0$, it is linear with respect to the increase of functional δy, i.e. $L[y(x), \delta y]$ is called variation of functional and means δv.

So, the variation of the functional is primary and linear with respect to δy, a part of the increase of the functional.

In the study of functional, variation plays the same role played by the differential in the study of functions.

Example 3.

We will look the functional

$$v[y(x)] = \int_0^1 y(t)\sin\left(\frac{\pi}{2}t\right)dt, \qquad x \in [a, b].$$

The increase of this functional can be expressed in the form

$\Delta v = v(y + \delta y) - v(y)$ where $\delta y = y_0(t) - y(t)$.

As applicable, in this functional, we have

$$\Delta v[y(x)] = \int_0^1 \left(y_0(t) - y(t) - y_0(t)\right)\sin\left(\frac{\pi}{2}t\right)dt - \int_0^1 y_0(t)\sin\left(\frac{\pi}{2}t\right)dt =$$

$$= \int_0^1 \left(y(t) - y_0(t)\right)\sin\left(\frac{\pi}{2}t\right)dt = \int_0^1 \delta y \sin\left(\frac{\pi}{2}t\right)dt$$

$$v(y + \alpha\delta y) - v(y) = \alpha\Delta v$$

$$v(y + \delta y_1 + \delta y_2) - v(y) = \Delta v(\delta y_1) + \Delta v(\delta y_2)$$

Therefore, the variation of functional $v[y(x)]$ is linear in terms of the increase δy and $\Delta v[y(x)] = \int_0^1 \delta y \sin\left(\frac{\pi}{2}t\right)dt$.

Example 4.

We will look the functional $v[y(x)] = \int_0^1 y^2(t)\sin\left(\frac{\pi}{2}t\right)dt$.

$$\Delta v = \int_0^1 (y_0(t)+y(t)-y_0(t))^2 \sin\left(\frac{\pi}{2}t\right) dt - \int_0^1 y_0^2(t)\sin\left(\frac{\pi}{2}t\right) dt =$$

$$= \int_0^1 \left(y^2(t)-y_0^2(t)\right)\sin\left(\frac{\pi}{2}t\right) dt = \int_0^1 (y(t)-y_0(t))(y(t)+y_0(t))\sin\left(\frac{\pi}{2}t\right) dt =$$

$$= \int_0^1 y(t)\delta y \sin\left(\frac{\pi}{2}t\right) dt + \int_0^1 y_0(t)\delta y \sin\left(\frac{\pi}{2}t\right) dt =$$

$$= \int_0^1 y_0(t)\delta y \sin\left(\frac{\pi}{2}t\right) dt + \int_0^1 y(t)\delta y \sin\left(\frac{\pi}{2}t\right) dt =$$

$$= \int_0^1 y_0(t)\delta y \sin\left(\frac{\pi}{2}t\right) dt + \delta y \int_0^1 (y_0+\delta y)\sin\left(\frac{\pi}{2}t\right) dt =$$

$$= \int_0^1 y_0(t)\delta y \sin\left(\frac{\pi}{2}t\right) dt + \delta y \int_0^1 y_0(t)\delta y \sin\left(\frac{\pi}{2}t\right) dt + \delta y \int_0^1 \delta y \sin\left(\frac{\pi}{2}t\right) dt =$$

$$= 2\int_0^1 y_0(t)\delta y \sin\left(\frac{\pi}{2}t\right) dt + \int_0^1 \delta y \sin\left(\frac{\pi}{2}t\right) dt \, \delta y$$

Therefore, the variation of functional $v[y(x)]$ is linear in terms of the increase δy and $L\left(y(x),\delta y\right) = \int_0^1 y_0(t)\delta y \sin\left(\frac{\pi}{2}t\right) dt$.

Now, we can give another, almost equivalent definition of the differential function and functional variation. Consider the value of the function f(x+α∆x) at fixed x and ∆x and variable parameter value α. When $\alpha = 1$ we get an increase f(x+ ∆x) in the value of the function when $\alpha = 0$ and receiving initial value of the function $f(x)$. It is easy to verify that the derivative of f(x+α∆x) of α at $\alpha = 0$ is equal to the differential of the function at the point x.

Indeed, from the rule for differentiating a complex function we have

$$\frac{\partial}{\partial\alpha}f(x+\alpha\Delta x)\Big|_{\alpha=0} = f'(x+\alpha\Delta x)\Big|_{\alpha=0} = f'(x)\Delta x = df(x)$$

i.e the differential function of $f(x)$ is equal to $\frac{\partial}{\partial\alpha}f(.$

For functionals of the type $v[y(x)]$, the variable can be defined as a functional derivative of $v[y(x)+\alpha\delta y]$ of α at $\alpha = 0$.

Indeed, if there is a functional variation in terms of basic linear part of the increase, then its increase is

$$\Delta v = v[y(x)+\alpha\delta y] - v[y(x)] = L(y,\alpha\delta y) + \beta(y,\alpha\delta y)|\alpha|\max|\delta y|$$

The derivative $v[y(x)+\alpha\delta y]$ of α at $\alpha = 0$ is equal to

$$\lim_{\alpha\to 0}\frac{\Delta v}{\alpha} = \lim_{\alpha\to 0}\frac{\Delta v}{\alpha} = \lim_{\alpha\to 0}\frac{L(y,\alpha\delta y) + \beta[y(x),\alpha\delta y]|\alpha|\max|\delta y|}{\alpha} =$$

$$= \lim_{\alpha\to 0}\frac{L(y,\alpha\delta y)}{\alpha} + \lim_{\alpha\to 0}\frac{\beta[y(x),\alpha\delta y]|\alpha|\max|\delta y|}{\alpha} = L(y,\delta y)$$

because there is the linearity $L(y,\alpha\delta y) = \alpha L(y,\delta y)$ and

$$\lim_{\alpha\to 0}\frac{\beta[y(x),\alpha\delta y]|\alpha|\max|\delta y|}{\alpha} = \lim_{\alpha\to 0}\beta[y(x),\alpha\delta y]\max|\delta y| = 0$$

because $\beta[y(x),\alpha\delta y] \to 0$ at $\alpha\to 0$.

Example 5.
We will look functional $v[y(x)] = \int_0^1 y^2(t)\sin\left(\frac{\pi}{2}t\right) dt$.

We find the derivative of this functional at $\alpha = 0$.

$$v[y(x)] = \left(\int_0^1 (y+\alpha\delta y)^2 \sin\left(\frac{\pi}{2}t\right) dt\right)'_{\alpha=0} = 2\left(\int_0^1 (y+\alpha\delta y)\sin\left(\frac{\pi}{2}t\right)\delta y\, dt\right)\Big|_{\alpha=0} =$$

$$= 2\int_0^1 y\delta y \sin\left(\frac{\pi}{2}t\right) dt$$

Therefore, the linear part with respect to the increase is $2\int_0^1 y\delta y \sin\left(\frac{\pi}{2}t\right) dt$.

Therefore, if there is a variation in the basic sense of linear increase of the functional, then there is variation in the derivative sense of a parameter at initial value of the parameter, both definitions are

equivalent. Thus, we can give another definition of functional variation.

Definition 8. Variation of functional $v[y(x)]$ is equal to $\frac{\partial}{\partial \alpha} v[y(x) + \alpha \delta y]|_{\alpha=0}$.

Definition 9. The functional $v[y(x)]$ reaches a maximum of the curve $y = y_0(x)$, if for the values of each functional $v[y(x)]$ near k, the curve $y = y_0(x)$ is fewer than $v[y_0(x)]$ i.e $\Delta v = v[y(x)] - v[y_0]$.
If , the equality is fulfilled at $y(x) = y_0(x)$, indicating that the curve $y = y_0(x)$ is reached strict maximum.

Analogously we can determine that the curve $y = y_0(x)$ reaches a minimum. In this case, for all curves $\Delta v \geq 0$ in the vicinity of the curve $y = y_0(x)$.

Prior to formulate the following theorem for functional, we will remember the following:
If differentiable function $f(x)$ reaches a maximum or minimum in an internal point $x = x_0$ in the domain of the function, at this point the differential of the function is equal to zero, i.e $df = 0$.

Theorem 1. If the functional $v[y(x)]$, which has a variation reaches a maximum or minimum at $y = y_0(x)$, where $y(x)$ are internal points of the domain of functional, its variation is zero at $y = y_0(x)$, i.e $\delta v = 0$.

Proof of Theorem 1
In fixed $y_0(x)$ and δy, $v[y_0(x) + \alpha \delta y] = \varphi(\alpha)$ is a function of α, that at $\alpha = 0$, supposedly reaches maximum or minimum, hence its derivative at $\alpha = 0$ is zero, i.e

$$\varphi'(0) = 0 \qquad или \qquad \frac{\partial}{\partial \alpha} v[y_0(x) + \alpha \delta y]|_{\alpha=0} = 0$$

. Therefore, the curve reaches an extreme of the functional, then its variance is equal to zero. (α can adopt values around the point $\alpha = 0$, both positive and negative values, as extreme concept of $y_0(x)$ are internal points of the domain of functional.)

The concept of extreme functional needs clarification. Multiband compression has been noted

above, the closeness of the curves may be interpreted differently, so that, when the maximum or minimum is necessary to specify the order in terms of distance. If the functional reaches a maximum or minimum of the curve, with respect to all curves, which is small, i.e. with respect to the curves in near-proximity sense the zero line, then the maximum or minimum is called strong. If the same functional $v[y(x)]$ reaches a maximum or minimum of the curve $y = y_0(x)$, only in respect of the curve close to the point in the proximity of the first order, i.e with respect to curves closer to not only the Y axis but also in the direction of the tangent, the maximum or minimum It called weak. Obviously, if the curve is reached strong maximum (or minimum), it is like reaching weak, as if the curve is near, meaning the proximity of the first order, it is close to and sense the proximity of zero order. Also, it is possible to curve reaches weak maximum (or minimum) and at the same time not reached a strong maximum (or minimum), ie between curves near as ordinate and the direction of the tangent may not exist, which (in the case when minimum) and between curves close ordinate, but not in the direction of the tangent, you can find those for which (in the case when the minimum).

II. CONCLUSION

Methods to solve variation problems are very similar methods to study the maximum and minimum functions, so the theory of maximum and minimum functions is close to the concepts and theorems for functional.

The variation of functional is primary and linear with respect to a part of the increase of functional and in the study of functional, variation plays the same role played by the differential in the study of functions.

If there is a variation in the basic sense of the linear increase of functional, then there is a variation in the derivative sense of the parameter with initial value, and that both definitions are equivalent which permit to give another definition of functional variation and a theorem, link between the extremes of a functional and its variation.

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E-LEARNING

E-Learning Application for the Primary School Students

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Abstract - In the past decade a growing number of institutions started applying the e-learning concept through web-based learning systems in order to change the traditional learning environment and monitor the students' educational needs. The lack of electronic materials both hardware and software in Macedonia primary education force the teachers to actively engage in the process of creating and developing their own educational applications. This paper demonstrates a successful e-learning application developed with Adobe Captivate, which is a powerful tool for creating interactive applications. The e-learning application is based on SCORM and it was evaluated by the students of VII grade primary school as well as with their teachers and parents. The evaluation showed that the e-learning application has accomplished its goal and it can be a foundation for developing similar application in all schools in the Republic of Macedonia.

I. INTRODUCTION

In recent years, Macedonian government made a significant investment of ICT equipment and applications in schools educational system increasing the usage of ICT in all subjects. Therefore teachers have to create electronic learning materials in order to improve the teaching materials, and students have the opportunity to learn in a different way that would result in higher achievement. Teachers made a transition from traditional classes [1] to online teaching and learning [2].

Special accent in the process of creating applications is placed on learning open source programs [3], which are available in all schools in Macedonia, and used in all classes. Since in curriculum open source programs Writer, Impress and Calc from Open Office are learned, from the book for Computer science aimed for students in VII grade, we decide to digitize part of the curricula in the form of educational interactive content in Macedonian language. This educational interactive material was available over the internet to the students both at school and home. As an example in this paper is presented the application for learning advanced techniques in Writer that is represented by

twelve hours teaching material for the students of VII grade.

As a tool for creating educational application we have chosen to use Adobe Captivate that offer a variety of possibilities, from creating projects for collaborative learning, interactive content for training, simulation, and quizzes, quizzes implementation and summarizing the students outcomes [4] [5] .

II. E-LEARNING APPLICATION DEVELOPED IN ADOBE CAPTIVATE

Adobe Captivate is the leading tool to create and maintain a wide range of interactive Flash and HTML5-based eLearning and e-Learning contents. It allows creation of software simulations and scenarios, software solutions designed to demonstrate multimedia content, interactive content, quizzes and similar content to improve the e-learning process.

Adobe Captivate supports recording, inserting and editing video projects as demo versions and their complementarity with audio, fields for writing texts, buttons, animations, other videos, a possibility to define actions for navigating the project through interactive facilities, to perform specific Java scripts and to execute other projects or scripts with variables [4] [12] created in Captivate.

Created projects have the opportunity to be published in various ways: as a Windows executive file (EXE) or MAC executive file (APP), as SWF and HTML5 formats, and as MP4 files if they are intended to display YouTube or are aimed for other devices such as Apple iPad and iPhone.

Adobe Captivate provides downloadable content created in other applications, such as Word and Power Point, for their further processing [6] [7].

A. Adobe Captivate Reviewer

Once Captivate project will be completed, the author can publish the project for review by competent persons - reviewers, on the internal server or on Acrobat.com. The project will be published as CREV file, and reviewers can see the project with Adobe Captivate Reviewer - AIR application [13].

Reviewers have the opportunity to add comments to a position on the time bar and can see the comments from others. Reviewers have the opportunity to export the comment as an XML file to the author. In this way the author gets specific guidelines for improving the project and its efficient software solution.

B. Learning management system (LMS)

We are using some of the leading systems for managing learning such as Learning management system (LMS) [8] [9] to distribute web-based tutorials created with Captivate to the Internet. The project placed on a LMS must be compatible with the Shareable Content Object Reference Model (SCORM) standards. SCORM is a set of specifications used for communication with between e-learning objects [10], and it is defined as communication between the client (in this case Adobe Captivate) and the host (some LMS, such as Moodle) Fig. 1.
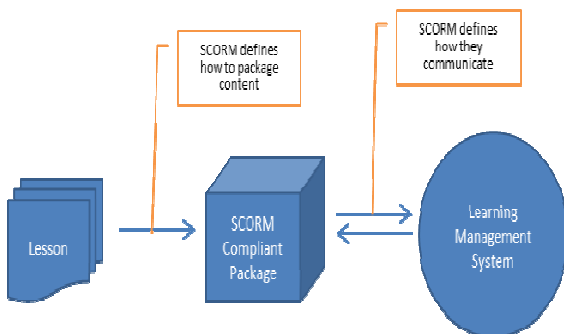
Figure 1 SCORM communication between the client and the LMS

Adobe Captivate provides options to make the project SCORM - compliant with these standards: Manifest File, HTML file, JavaScript File and other files which contain information required for LMS [11]. Then the announced package of LMS can be directly sent.

C. Adobe Captivate Quiz Results Analyzer

If the points from quizzes are not being monitored on LMS, Adobe Captivate provides reporting capabilities, such as Acrobat.com or an internal web server [14]. Once the user has confirmed the quiz results, Quiz Results Analyzer as AIR - based application starts the analysis of the

results in online and offline mode. It is enough to set reporting preferences and then the application runs in the background without any user intervention. The application provides an opportunity to review a detailed report with the results of all users who have completed the quiz, to create and edit the report, to save the results in a local folder in order to be viewed offline, as well as creating of partial reports for comparison of results and printing reports.

III. INTERACTIVE APPLICATION FOR LEARNING AND GAINING SKILLS

The application for learning and gaining skills in Open Office Writer was organized in several modules: learning, practicing, testing and additional learning resources. For better navigation across processed material, on the application workspace are displays the contents with all units that are processed by modules. Each module is a project in Captivate with .swf format. The various projects are set in aggregator which is an interactive application for e-teaching and e-learning with possibility of upgrade.

A. Adobe Captivate Reviewer

During the application execution, the user is introduced with the application contents and its features. Using the navigation key, student can access additional resources for learning, leading to relevant sites related to content being processed (Fig. 2). In this way we can satisfy the needs of students who want additional knowledge, simultaneously reinforcing the safe use of Internet, giving students concrete directions for searching. For all users who need to ask questions or give suggestions related to the application, there is a link to contact the author. The application can be upgraded and developed towards students' needs for acquiring permanent knowledge.
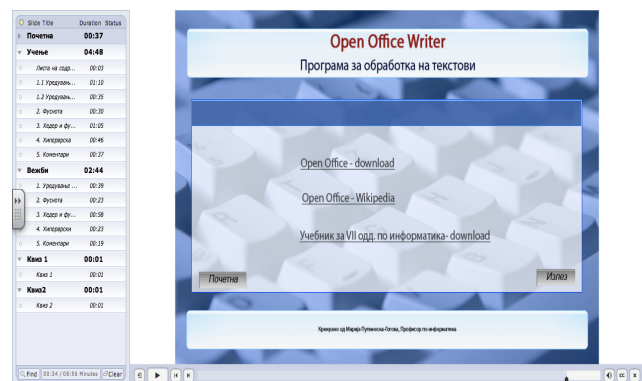
Figure 2 Additional learning materials

B. Visualization of teaching contents

The application contains a learning module that presents Writer from Science book for seventh grade. For navigation the curriculum titles can be used for navigation, that when selected a brief description is displayed. Each teaching unit begins with terms that student should learn and the explanation of the activities.
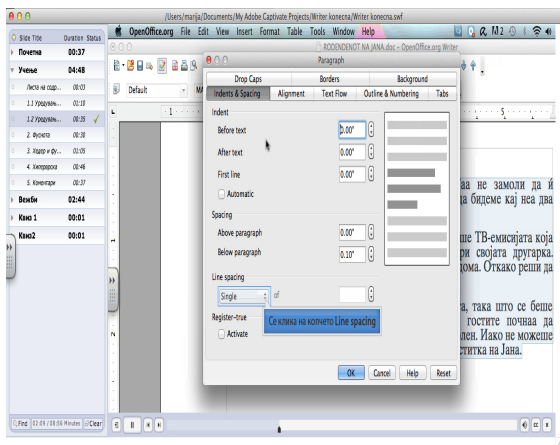
Figure 3 E-learning material

Following the contents, all the steps are clearly being described for which the student have to learn and perform the tasks (Fig. 3). For example, when editing Writer document, how to set the header, footer, footnote, comment, add hyperlink and so on. Following steps shown on the screen, the student with mouse click on the marked can see the additional application features.

C. Interactive exercises

Interactivity is one of the more powerful features to create educational materials designed for e-learning and therefore they are created in our application. The objective is to make student skilled in performing previously learned steps and to motivate him for self-solving problem situations. Each exercise begins with the manual for work and specific tasks that the student needs to do to successfully complete the exercise. Students perform the actions with mouse and keyboard. Each correct step enables the student to proceed with the task, and a wrong step produce an error message that is displayed in red color (Fig. 4). Furthermore, in case if student need help, the correct step is displayed or a displays messages that resemble the following task. At the end of the exercise there is a message in green color for successfully complete the task.
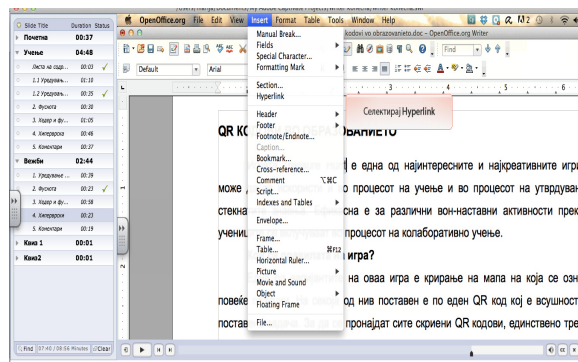
Figure 4 Interactive exercise

D. Quizzes for student self-assessment

Self-assessment of knowledge is an imperative of modern time that includes students in the evaluation process. In our application, students can self-assess themselves through quizzes with different kind of questions: a multiple-choice, with addition, matching, sorting, selecting from a list with more features (Figure 5). Quiz questions appear in random order each time while the quiz is active. At the end of each quiz the student receives a detailed overview of the number of answered questions, scored points and number of attempts. For students who correctly answered all the questions a motivation message are displayed as: Bravo! All answers are correct. The students, who have made mistakes, have the opportunity to review all the questions and try to give the correct answer.
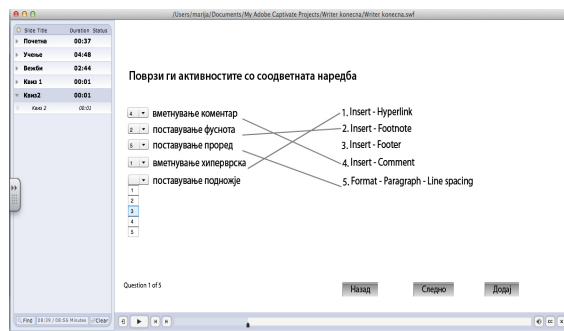
Figure 5 Quiz with different types of questions

IV. EVALUATION

We have published the application for learning advanced features in Writer on www.acrobat.com and on educational platform www.edmodo.com, and users were able to access them online or download on their computer. The application was evaluated by 84 students of VII grade from the primary school "Bratstvo Edinstvo" - Ohrid, their parents and 15 teachers who teach science, mathematics, biology and geography. Based on the conducted evaluation we were able to confirm the positive impact of

electronic educational materials on the overall process of e-teaching and e-learning.

All students have shown significant interest and motivation to work that the traditional way. In terms of overcoming the lessons, students perceived new concepts and ways of implementation of a given activity. Those students who needed more times to follow the same content could do it from their home. Some students who have difficulties with information terminology and didn't show interest in using a book, through application were motivated to learn new concepts and follow the e-learning material, performing much better than before.

Through interactive exercises students practically performed the given tasks and followed comments on each step. Part of the activities they learned through their mistakes and successfully completed task motivated them to gain new knowledge and skills.

The various quizzes provided the opportunity for self-assessment. Correct tests raised the confidence among students, and their interest in solving new additional quizzes throughout the year. Students believe that the collection of quizzes will be an excellent base in preparation for external assessment.

Students used the application contents at home and at school. Some parents expressed their satisfaction with the way their children learn, gain knowledge and overcome the barriers of computer technology.

Teachers involved in evaluation expressed their satisfaction of the interactive applications as excellent solution for simplify learning process and gaining skills. Science teachers expressed their motivation and willingness to create their own original applications that would enrich aggregator of educational materials in informatics.

V. CONCLUSION

The research demonstrated that the students are motivated to independently engage in the e-learning process that is adapted to their abilities and interests. The interactive content has helped the students to solve problem tasks, learn more interactively and gain everlasting knowledge. Creating quizzes with different types of questions encourage students to learn and use computer terminology, and also to control their progress and achievements in the field of computer science.

The produced application was tested on 84 students of seventh grade, including their parents and teachers. All of them were satisfied by the results that have demonstrated that it is valuable as for the students, and for the overall education process to implement e-learning into future classes.

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MOOC vs. Traditional Learning –Possibilities and Weaknesses of E-learning Sites

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Abstract - As a member of a research team at the University of Szeged, we have started to develop a new e-learning platform for teachers and students of the next generation. As a first step, a literature review helped us collect good examples and studies in order to prepare a summary and to define "how an e-learning platform looks like today". It has been well established that software and hardware make up just one part of the e-learning environment; therefore we had to identify methodological possibilities and weaknesses among cases of traditional and electronic learning out of which we developed a plan for our new platform.

This paper aims at presenting my research in the field of E-learning and distance learning, with the topic: methodical possibilities and weaknesses of e-learning sites. Firstly, in my analysis, I intend to show those main components which are necessary for good e-learning sites, from the students' and the teachers' point of view. Our platform will contain an automatic logging service, which could be of great help to teachers. Secondly and most importantly, I have made a collection of potential measurement objects which can help us to generate automatic reports of validity for teachers.

I. INTRODUCTION

Nowadays, the way we approach communication, industry, and learning has considerably changed and developed. For example, a few years ago video games were all played offline, but by today most of them have been transformed into online applications. Furthermore, we have to mention e-mail services as well, which have become the primary communication tools for universities, but according to some studies they come with a considerable and recent novelty showing that students avoid using emails putting Facebook and Viber forward [6][11]. If we take a look into relevant research and publications, we have to realize that our education system has to find alternative ways to distribute knowledge for the next generation to include "up-to-date" services for students and teachers [10]. It is necessary since the access to the Internet and broadband connections have increased rapidly and a huge growth in mobile connectivity has brought online content and interaction to the global audience. At the same time, open online distance learning in higher education has quickly gained popularity, expanding and evolving at the same time. Recently, according to

[21], Massive Open Online Courses (MOOCs) have appeared to be a significant force within higher education, while within the current educational landscape Massively Open Online Courses (MOOCs) have stimulated extensive interest and hype in a short time [18]. As a result, education has never had such intense social effects before. Lately, the most prestigious universities worldwide have been publishing academic resources in open environments resulting in generating hundreds of thousands of users of online platforms, and a similar number of enrolments each academic year [2]. The popularity of Massive Open Online Courses (henceforth MOOCs) is gradually expanding, and the perceived educational add-value of their scalability to the masses is growing [16].

Massive open online courses (MOOCs), a synonym for a recent modality of distance learning wherein course materials are made available online and are freely accessible to anyone with a computer access, have been rapidly gaining popularity as new platforms and courses online [22]. However, while new web technologies (MOOCs) allow for scalable ways to deliver video lecture content, to implement social forums, and to track student progress, we remain limited in our ability to evaluate and give feedback for complex and often open-ended student assignments [21].

II. ABOUT MOOC

Why are MOOC courses so popular? One apparent response to this new trend is real financial investment: text book publishers are rapidly re-inventing themselves as purveyors of on-line education and are lobbying the government for an equal slice of pie against universities; in the meantime, venture capitalists are lining up at universities' doors trying to buy themselves a share of more popular courses [18]. But what is MOOC in fact? Massive Open Online Courses (MOOCs) are digital (academic) teaching formats which offer stimuli for developing the concepts of e-learning, Web 2.0 and open educational resources [9]. These academic courses are available worldwide to the

general public; there are no preconditions; and they are usually free of charge [13][8][3][4][19]. A typical MOOC of 2014 could have taken place over 4 to 10 weeks and video lectures were the primary and an extremely crucial part when MOOC instructions were designed [20]. Students, on average, dedicate two to six hours a week to a course [21]. MOOCs offer an immense amount of innovative potentials in a wide geographic range having the capacity of reaching a good deal of participants; furthermore, they offer the use of collaborative formats and transparent teaching methods [9].

The field of open and distributed learning has experienced a surge of media coverage and public interest in the last several years, largely focusing on the phenomenon of massive open online courses (MOOCs). The term MOOC has been used to describe a diverse set of approaches and rationales for offering large-scale online learning experiences. MOOCs have been delivered using both centralized platforms and services including learning management systems (LMSs) and decentralized networks based on aggregations of blog sites and social media feeds. MOOCs have been designed to support university curricula, academic scholarship, community outreach, professional development, and corporate training applications [1]. Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Do not use abbreviations in the title or heads unless they are unavoidable.

III. POSSIBILITIES AND WEAKNESSES

Higher education institutions are quickly coming to terms with e-learning making it a routine, which is a surprise [9]. MOOCs are, therefore, stimulating important transformations in higher education, especially by encouraging online teaching and learning in regular credit programs [7]. Apart from the "one size fits all" approach that MOOCs follow, they can be characterized by scaled up class sizes and the lack of face to face interaction coupled with such high student teacher ratios [20]. In this sense, some studies have been done in order to find out which aspects influence the apparent high drop-out rates to show if this one should raise concerns or not. This failure is attributed to academic subjects, the heterogeneity of participants, and the curiosity that is awoken in a learner who has no real intention to do the course [2].

On the other hand, modern technological solutions allow the collection of users' logs like clicking attitudes, video click stream interactions, etc. Whilst data provide several opportunities for quantitative analysis of users, their learning

journeys and their use of learning resources, data analytics makes only a very small contribution to evaluate the success of a SOOC [12].

Modeling user experience in MOOCs supports research efforts to better understand user needs so that experiences that are more conducive to learning can be offered in the future [5]. Determining how learners use MOOCs effectively is critical to providing feedback to instructors, schools, and policy-makers on this highly scalable technology [22]. Measuring equipment is able to do this job but it is not yet fully developed and an urgent improvement would be highly appreciated.

We have to realize that the rapid growth of public and educational interest of MOOC will provide a real opportunity to collect massive data from users, which can in turn help us to increase the accessibility to knowledge and information resources to understand users' attitudes and needs. This will probably help us understand why MOOC generates so high drop-out rates.

IV. OPEN QUESTIONS AND POTENTIAL ANSWERS

The most explicit criticism against distance learning is the fact that it isolates communities, provides a poor platform for an in person communication between teachers and students. This has been underpinned by El-Hussein [14] who stated that we would be able to expand traditional classroom learning environments using smart devices with built in Internet accessibility, though new virtual obstacles and barriers may arise [14]. One of the challenges that Massive Open Online Courses (MOOCs) face is that they lack a physical medium that enables active real-time interaction between students and instructors, especially when compared to an offline learning environment. [17]. In a typical MOOC, between 5% and 10% of students actively participate in threaded discussion forums [5]. In another research conducted by Bergner [22], it was revealed that hundreds of students scored very high on the final exam of a course but spent almost no time learning; in other words, these students already knew the content, but took the tests for fun or for the certificate [22]. The opportunity of downloading a learning pack and its use in an offline learning environment seems viable, but cannot be treated as a real learning environment since it lacks its positive benefits.

To solve the problem of motivation, some studies investigated online forums and found connections between drop-out rates and students' forum attitudes. They revealed that there are some students who accommodate themselves to this situation voluntarily helping others by answering questions in discussion forums. Student leaders encourage other

students to participate in discussions to make online learning experience much more collaborative and engaging [17].

Further research topics could be self-motivation, circumstances and decisions that make somebody participate in a course, and the persistence to complete a course.

The basic types of motivation are enumerated by White et. al. [18]:

- MOOCs are free and open,

- MOOCs are convenient: fitting around life, MOOCs enable learning with the best,

- MOOCs professional development and lifelong learning,

- MOOCs satisfying interest and usefulness.

Some researchers have found that extrinsic motivation can greatly influence the success of a course completion [23]. Schultz [9] found that course achievement can drop down to 10%, while in a study conducted by Námesztovszki et. al.[23] this number was much higher reaching 50%. Factors that may influence research data include additional points that can be added up to the exam results. A further opportunity is the use of MOOC blended learning, which can take advantage of the benefits of a traditional face-to-face and on-line education. A case study by Schultz [9] reveals that there are asynchronous teaching segments such as recordings and forums, as well as synchronous live sessions. Similarly to the concept of "blended Elearning", "blended MOOCs" have also emerged at which participants or groups are physically present as well [9].

There might be a solution in the form of an adaptive learning platform, though it is still a utopian idea because neither of the current systems are feasible for MOOC instructors to manually provide individualized attention that caters to different backgrounds, diverse skill levels, learning goals and preferences of students, there is an increasing need to make directed efforts towards automatically providing better personalized content in e-learning [20].

Meanwhile, institutions are making increasingly significant investments to produce MOOCs, and learners are enthusiastically enrolling in large numbers, often in tens of thousands. The analysis presented identifies a spectrum of motivating factors for universities, and suggests likely areas for future attention and developments. It further identifies a range of motivations of learner participation, which may not be identical across cultures and which

MOOC providers might wish to take into account [18].

A plausible path would be the improvement of pedagogical-technological solutions. What is needed? Are new methodologies for development and interpretation of models that bridge expertise from machine learning and language technologies on one side and learning sciences, sociolinguistics, and social psychology on the other side [5]. Self- and peer assessment might offer promising solutions that can scale the grading of complex assignments in courses with thousands of students. Moreover, intermediate assessments might engage more students with participating in a course [21]. Nevertheless, another school of thought, mainly academic, places its focus on aspects like: pedagogical design of the MOOCs, the roles of the teacher and student in these massive courses, the high rate of drop-outs in MOOCs, the difficulty to confirm the physical personality of the participants, the limited validity of the accreditations [2].

In a world increasingly multidimensional and diverse, MOOCs can work in universities as a piece of the system providing open learning opportunities, forming part of the learners' personal learning network [18]. The large scale linguistic data that is generated by discussion boards, blogs, and other written language-based interaction tools that are/can be part of the MOOC technology infrastructure provides an unprecedented opportunity to study the dynamics of students' interaction, learning engagement, and ways in which critical valuable learning/teaching discourse is constructed around different knowledge topics [16]. Beyond that, automated analyses enable adaptive technology to tailor the experience of users in real time [5]. Incidentally, we can explore at a micro level whether, and how, cognitive mind states govern the formation and occurrence of micro level click patterns [20].

V. WHAT TYPE OF DATA ARE WORTH ANALYZING IN LINE WITH A COURSE?

The aforementioned instances of research reveal that the key to a successful course is to be found in the learners' motivation and behavior. The questionable fields can be assessed by post testing whose drawback is the timing of data-result recording that happens long after taking the test; as a result, the participants would forget how they approached and completed a task, or how they reached a correct or a wrong answer [10]. Besides, post testing that aims at studying behavior and opinion show significant discrepancies during an instantaneous and a follow-up feedback making it impossible to draw a reliable and clear picture [15].

Knowing this, it would be highly necessary to investigate other logging methods that are capable of real-time data collection. Results obtained through such tools "without the knowledge" of the user would feed objective data to the researchers. Such a solution was demonstrated by Sinha et. al. [20] who recorded mouse activity during video streaming and analyzed the results afterwards. We could also mention who conducted a survey to unfold the perspectives of education through video lectures. A MOOC course, however, would require to bring forth the traditional textual and presentation based teaching, thus it might be wise to carry out a logging study while students are reading. Furthermore, forums may also contain some useful information, though forums at MOOC courses are the least used opportunities to engage in communication that barely reaches 5%, still it may carry useful information on students' communication habits on forums [12].

VI. CONCLUSION

To conclude, several studies in this paper support the hypothesis that video supported digital learning is gradually gaining ground and popularity. We should not forget however that the drop-out rate and the rate of discarding a course are significantly high, which is the current drawback of MOOC courses [18]. It is thus imperative to track all the conditions that lead to a successful completion of a course.

The instances of research mentioned in this paper reveal that the key to a successful course is to be found in learners' motivation and behavior.

Academic papers published on this issue are useful to an extent; however, educators with "basic training" in this field would usually miss the opportunity to show a significant development in this area during their everyday work. As a consequence, future MOOC platforms have to be supplemented with logging and automated statistical algorithms, beside esthetic and pedagogical implementations in order to track students in real time.

Based on pieces of research in the academic literature, we are able to establish a list of the most important logging categories:

- Attitudes and forms of behavior during viewing a video

- Learners' activity on a course forum

- Textual and slide based learning materials and the attitudes how they are approached, and forms of behavior.

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Learning Software Engineering Basics Through Robotics

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Abstract – Software engineering is a scientific discipline that deals with all phases of (requirements analysis, design and modeling, implementation, evaluation and validation, as well as maintenance). Learning various concepts of software engineering is not a trivial task, and requires more than a one semester course. LEGO MINDSTORMS NXT kit is a popular and affordable education robotic platform, used as an educational tool in various areas. This paper describes how the LEGO MINDSTORMS robots can be used for teaching the basics of software engineering. We have also evaluated the outcomes of the course in order to reveal the effects of using this off-the-shelf robot kit.

I. INTRODUCTION

In a world where technology leads the economic and social development of the countries, the significance of a good academic engineering training must be considered as a core aspect in every educational system. Such engineering training must cover both theoretical aspects as well as practical applications that show the students how to relate the abstract knowledge they learn in the lecture sessions with real world problems and their difficulties.

Robotics has been shown to be a superb tool for hands-on learning, not only of robotics itself, but of general topics in science, technology, engineering, and math (STEM) [1].

A broad spectrum of robot tools and platforms that can be used in educational process exists, but we will concentrate on the LEGO MINDSTORMS NXT kit, because it provides students and teachers with a user friendly environment and gives the students opportunities to engage in real world science through, design, construction, and testing of their own experiments. Additionally, many students are familiar with LEGO. Some have used them in their childhood, others use them in computer games and they even see them in films.

LEGO modular design allows for multiple solutions to a given assignment, and the sensors and motors allows students to engage in a very diverse set of engineering and science activities. By allowing those to solve problems based on real-life situations, the students can developed critical thinking and learn confidence, problem-solving and teamwork.

LEGO MINDSTORMS has been used as an educational tool in various areas. Brandt and Colton [2] have used Mindstorms to teach underground students Programming, mechanics and control. Tester [3] used Mindstorms to develop skills connected with innovation and communication management. Schumacher, Welch, Raymond [4] have used Minsdstorms to teach Programming to Electrical Engineering and Computer Science freshman students from the Military Academy in the US. Caci and D'Amico [5] used Mindstorms to develop cognitive skills in children. Fabri et all.[6] have been used Mindstorms for teaching and learning software processes and project management. Church, Ford, Perova and Rogers in [7] describe a successful use of LEGO MINDSTORMS in designing robotics-based activities for teaching physics. Cruz et all. [8] have been used LEGO Mindstorms NXT for teaching at Data Acquisition, Control Systems Engineering and Real-Time Systems undergraduate courses.

However including LEGO MINDSTORMS or other robot systems in the course syllabus does not automatically mean better results of concepts by students. In order to have a teaching value, their use must be carefully designed, which requires a higher dedication of teachers.

We have tried to use robots within the course aimed at teaching the basics of software engineering. The robots were used as tools for physical representation and visualization of object-oriented software algorithms and design patterns. Moreover, dealing with physical objects should make the learning more intuitive than just looking at in-memory object structures [9].

The main objectives of the course were to teach the students on the basics of software modeling and development starting from a set of user requirements. As a final outcome students should also have to gain practical experience of

collaborative project development in a simulated production environment.

We have evaluated the outcomes of the course in order to reveal the effects of learning software engineering in robotics environment.

The evaluation results showed that students have gained practical experience and good understanding of software engineering basics and they have appreciated the proposed methodology.

This paper is organized as follows. After a brief introduction and related work overview, the paper continues with the description of LEGO MINDSTORMS NXT kit. Next section describes the course curriculum and presents one pedagogical unit. The paper then discusses the results of the pilot study and presents the conclusions.

II.   Lego Mindstorm Kit V2.0

The Lego Mindstorms NXT 2.0 kit contains software and hardware to create customizable, programmable robots.

It contains three motors, one light sensor, one ultrasonic (sonar) sensor, one sound sensor, and two touch sensors. The servo motors included in the kit are equipped with rotation encoders, returning to the

NXT the position of the shaft with 1 resolution.

Rotation speed of the motors is proportional to voltage applied to them, as it can be seen on graphs in Figure 1.
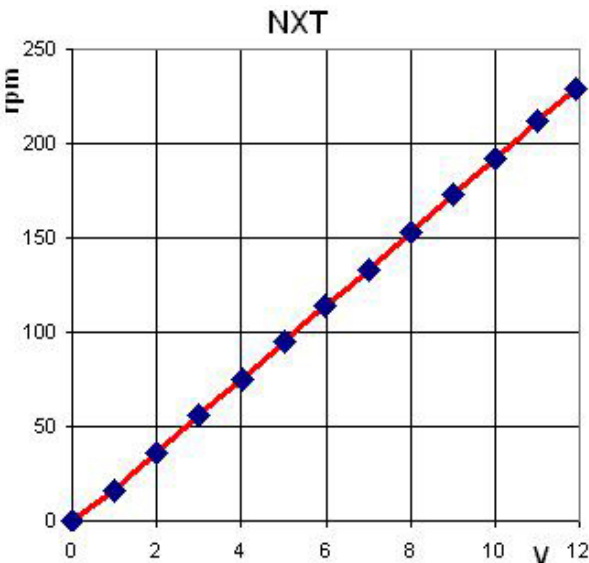
Figure 1. Dependency of the rotation speed from the applied voltage.

Two motors can be synchronized as a drive unit. Ultrasonic sensor included in the kit has accuracy up to 3 centimeters and can measure up to 255 centimeters. The light sensor can distinguish between light and dark but, in the same time can be

used to recognize whether the surface color of the scanned object falls in a specific color range. Sound sensor can be programmed to give the robot the ability to hear and react. The robots can detect physical contacts with the environment and react accordingly using two touch sensors included in the kit.

The kit also contains set of 619 mechanical parts from the Technic line aimed at creating various mechanical systems and robots. The kit also includes an intelligent *brick* computer that controls the system.

The core of the ―brick‖ is the 32-bit Atmel ARM7 processor with 256 KB Flash, 64 KB RAM operating at 48 MHz. Even without its coprocessor, which is an Atmel 8-bit AVR processor, the brick is a powerful embedded platform that can be used to build variety of applications [10].

The architecture of the LEGO Mindstorms NXT Brick is presented in Figure 2.
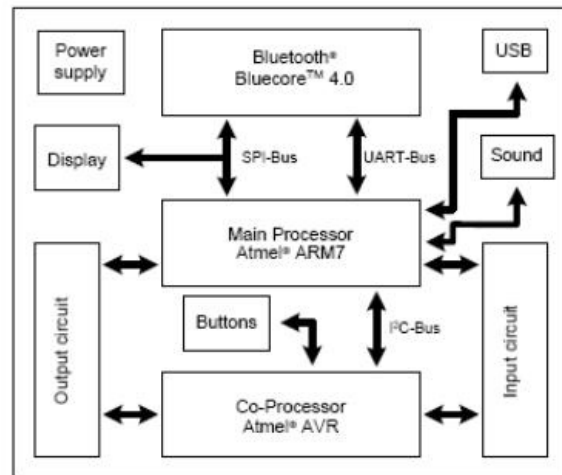
Figure 2. Architecture of the LEGO Mindstorms NXT Brick [11].

Mindstorms consists of a largely graphical interface for writing programs (Figure 3) and a flexible and simple means – the use of Lego blocks – for constructing the physical robots.

Both the programs, which can be recorded as they are constructed and edited, and the robots, which can be described in some detail; provide excellent artifacts of student critical thinking and problem solving.

There are several things of interest to educators – first, the program is completely graphical – this helps students focus more on the design rather than spend time on learning new tools and associated abstract syntaxes. Second, because the program is graphical, it lends itself naturally to parallel programming which is an inherently hard concept to teach with traditional tools. Third, the student can

configure all the parameters associated with a block at the bottom of the screen without having to navigate through multiple functions and files and finally, the software exposes key embedded concepts such as memory and resource management, helping teach the key concepts in a fun environment. For example, the student may have to, depending on the size of the program, remove some other files that were taking up memory on the brick
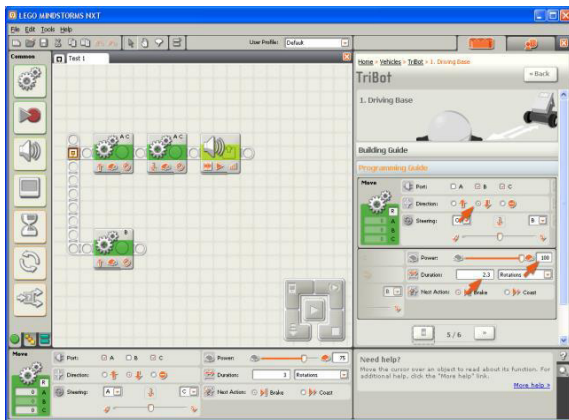
Figure 3.   The Software for the LEGO MINDSTORMS NXT.

III. COURSE DECRIPTION

Fast developing society based on technological advancements is focusing on complex hardware and software solutions. Software is becoming the main driver for growth in many fields. This is valid not only for enterprise software solutions but also for industrial embedded software, consumer products (phones, smart TV's, and robotic devices which are penetrating very fast nowadays). In order to meet the challenges of rapidly changing demands and requirements, as well as the permanent increasing of software's size and complexity, systematic approach is needed.

Software engineering is the scientific, disciplined and quantifiable approach to developing, operating and maintaining complex software systems.

Software engineering education at undergraduate level could not satisfy the specific requirements for industrial software development. Namely, in addition to requirements for embedded software development, the industry also requires the knowledge of entire software lifecycle phases (requirements analysis, design and modeling, implementation, evaluation and validation, as well as maintenance).

Therefore, we have offered a multidisciplinary course entitled Basics of robotics that teaches both software engineering and robotics aspects.

The main objectives of this course it to enable students gaining practical experience of sensing, planning and control and apply it on a small-scale educational Lego Robot. In parallel the course should provide the students with basic software engineering methodologies, design and modeling of robotics software, implementation of control software.

The course is offered as a single semester course in the 4th year of study (8th semester) and the main topics are balanced between software engineering and robotics. They are including: design patterns, modeling methods and tools, implementation patterns, localization and mapping, object recognition, path planning and robot control.

During the course four different assignments were given to the students. Through the analysis of the given assignments, the students' improvements from software engineering aspect were evaluated.

The course was attended by 35 students (22 male and 13 female). All of them were with the same software engineering and robotics knowledge gained during the previous academic years.

A. Description of line following assignment

The main idea of this assignment is to understand the differences between sequential programming and state machine pattern. For this purpose the students should use the Lego Mindstorms NXT 2.0 to construct the line follower robot using two light sensors (Figure 4).

Figure 4. Line follower robot

The logic besides the control algorithm could be seen from the illustration in Figure 5.
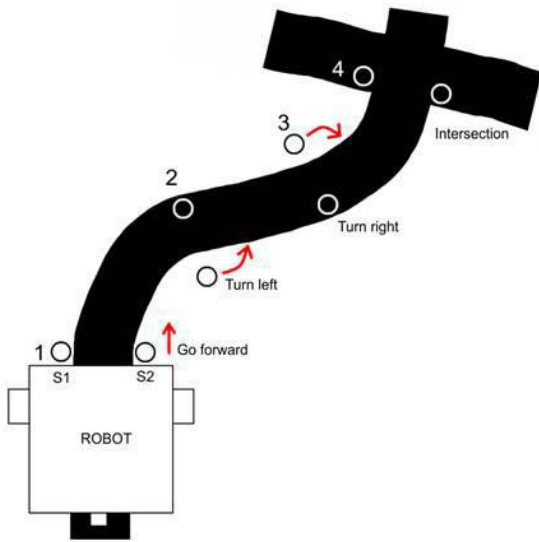
Figure 5. Control algorithm logic.

So, considering two light sensors (S1 and S2) attached on input ports 2 and 3 correspondingly we may have the following combinations: both S1 and S2 detect white background the action should be go straight, S1 detects white and S2 – black, the action should be turn right, S1-black and S2 – white, the action should be turn left, and finally both sensors detect black, the robot should stop due to crossroad.

The Lego software diagram that is solving this problem is given in Figure 6.
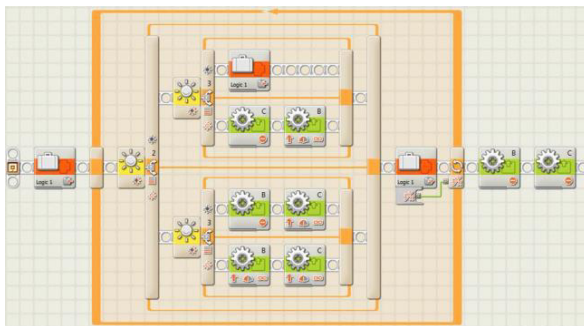
Figure 6. Four step line follower control diagram.

IV. EVALUATION

The methodological approach was evaluated in two different ways. First of all the quality of assignments during the semester was evaluated. The qualities of assignments were evaluated by two professors, one assistant and one PhD student (employed as laboratory assistant). The results have showed that all students have presented improved qualities of their software engineering approach after the second assignment. This conclusion was made unanimously by all four teaching staff members.

Besides this evaluation, the students were interviewed at the end of the course and asked to fulfill a questionnaire composed of several questions (given in the Table 1 below). The results are also presented in the Table 1 presented below.

TABLE 1.

N	Question	Mean	STD
1	Were the practical assignments interesting or motivating? (1-not interesting; 5-very interesting)	4.32	0.35
2	Usefulness of Lego NXT in learning software modeling? (1-not useful; 5-very useful)	3.87	1.20
3	Usefulness of Lego NXT in learning embedded software implementation? (1-not useful; 5-very useful)	3.76	1.05
4	Usefulness of Lego NXT in learning robotics basics? (1-not useful; 5-very useful)	4.19	0.95

V. CONCLUSION

We have presented in this paper a teaching innovation project devoted to the use of LEGO Mindstorms NXT robots in subjects related to software engineering.

Our experience using these robots has been really positive. Our students find the lab sessions more attractive, and they solve the proposed practical exercises more enthusiastically; this perception is statistically supported by the results of the surveys we have conducted in different subjects and, more slightly, by the scores obtained by the students, which we believe comes from a higher motivation. On our behalf, we have found that the NXT is a nearly optimal education platform in terms of cost, robustness and versatility.

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Big Data in Education

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Abstract— In the 21thcentury every process and every little movement generates data which are stored digitally. In many cases this accumulated raw data can exceed Terabyte, Petabyte or even Exabyte storage space. This data in its raw form does not provide new, valuable information, and knowledge but needs statistical and data mining methods to obtain any. According to Big Data in Big Companies study from 2013 published by SAS, a leader of business analytics software market, companies can gain market advantage and increase their profit with this knowledge. Using such technologies, we can make the economy not only better but also we can improve the education's efficiency.

According to new trends, on-line education is becoming more and more popular thanks to its advantages like learning free from any fixed time and place. In the virtual environment students can reach course materials, can practice and communicate with their classmates and teachers while the system records, logs the reached milestones, the test results and the time spent in this environment. Working together with the University of Szeged Methodical Research Team we are developing a system that stores and processes as much useful data generated by student activities as possible helping course material customization thus improving the education's efficiency.

I. INTRODUCTION

The notion of Big Data has formed the basis of discussion in an increased number of studies making an attempt at exploiting its potentials. As a matter of fact, what do we mean by Big Data?

Rob Kitchen describes Big Data as having the following characteristics: huge volume, consisting of terabytes or petabytes of data; high velocity, being created in or near real time; extensive variety, both structured and unstructured; exhaustive in Veracity to the previous categories which denotes that recorded data can be entirely distinct affecting the precision of data analyses [4].

Big Data analysis is in close connection with data mining which connects the field of data mining, statistics, and artificial intelligence; furthermore, it aims at touching upon hidden relationships that would help gain new knowledge not only in the commercial field but also in the area of economics providing useful information. Taking this acquaintance as a basis, Danah Boyd and Kate Crawford created the following definition of Big Data: "It is the kind of data that encourages the

scope, striving to capture entire populations of systems; fine-grained resolution, aiming at maximum detail, while being indexical in identification; relational with common fields that enable the conjoining of different data-sets; flexible, with traits of extensionality (easily adding new fields) and scalability (the potential to expand rapidly) [1]. Doug Gartner the analytic of the Gartner company (former META GROUP) named three characteristics of Big Data, later dubbed the Model of "3Vs": increasing volume (amount of data), velocity (speed of data in and out), and variety (range of data types and sources) [2]. In 2012, this definition was corrected adding the following supplement: "Big data is high volume, high velocity, and/or high variety information assets that require new forms of processing to enable enhanced decision making, insight discovery and process optimization." Gartner's definition of the 3Vs is still widely used, and is in agreement with a consensual definition that "Big Data represents the information assets characterized by such a High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value" [3]. Volume actually means that big data is not a sample; it just observes and tracks what is going on generating sometimes terabytes and sometimes even petabytes of data pile. Velocity covers the fact that Big Data is accessible in or near real time. Variety refers to the diversity and manifoldness of data which can originate from picture, audio, video files, or even entries on social websites. IBM is considering a four V model adding

practice of apophenia: seeing patterns where none actually exist, simply because massive quantities of data can offer connections that radiate in all directions" [5].

This agenda has raised the attention of lots of researchers diversifying the results and opinions on the subject of Big Data. On one end of the spectrum stands the idea that "With enough data, the numbers speak for themselves. Petabytes allow us to say: "Correlation is enough." We can stop looking for models. We can analyze the data without hypotheses about what it might show. We can throw the numbers into the biggest computing clusters the

world has ever seen and let statistical algorithms find patterns where science cannot" [6]. On the contrary, the representatives of the counter opinion on this matter are more discreet drawing attention to the idea that knowledge cannot be fabricated on a production line but requires careful investigation into the circumstances and time, based upon which the collection of data can be put under scrutiny. He also points out that „Bigger Data are Not Always Better Data" [7]. Lastly, the authors emphasize that despite acquiring a series of data, it is not always clear if their use is ethical or not; furthermore, supplementing this line of thought Sara Briggs draws attention to the errors that may arise from some of the assumptions: „As companies like Google have extended the services they offer to include email, document storage and processing, news, Web browsing, scheduling, maps, location tracking, video and photo sharing, voice mail, shopping, social networking and whatever else might be of interest to their users, they gain access to even more personal data, which they collect, store, and cross-reference. Even information that is accessible to the public, when assembled from different sources into a comprehensive dossier, can create a revealing picture of a person. A simple Google search can turn up an enormous amount of information about an individual, though the accuracy of much of it is questionable" [8].

II. WHY DO WE NEED BIG DATA IN EDUCATION?

The main point of concern is how to measure a methodological supposition during a pedagogical investigation with the intention to compile a research paper. In our days, the most used form of conducting a survey is still the traditional method (in person or over a phone call) being the interview based questionnaires, which meant to be the only and the most precise measure instrument. However, it has been proven that if the designers of a survey do not proceed carefully during their work, they might face the so called effect of "the designers' subjectivity" [9]. Due to such proven factors, particularly if the researchers are charged of designing the interview, they might lead the interview subjects toward their suppositions, which would in turn generate an invalid set of answers in the questionnaire. To avoid such mistakes, researchers can use various techniques, one of which is the cooperation of the designers who are charge of taking care of a limited number of survey participants [9]. Another solution is available if the testing is conducted in an impersonal style lacking any connections that may ruin the reliability of the results. For example, paper based testing falls under this category, though the amount of information that this traditional method can carry is usually irrelevant

and on top of that in case of a large volume testing, processing takes time and is laborious [11]. The Internet and the technology that comes along offer a wide range of alternatives to these obstacles providing free or charged real time processing technologies of analysis as part of the researchers' repertoire. Survey designers are, thus, able to reach several electronic or online tools when testing like: mixed questions, drop-down menus, textual hints, all of which can broaden the opportunities of a traditional paper based testing. Further advantages are clearly visible if researchers incorporate a list of multimedia tools, which can motivate and guide the participants during testing. The former solutions are a giant leap in the field of survey design but beside advantages they carry a good deal of perils. The most important being the shortcomings of the sampling framework which can jeopardize the evaluation of the obtained raw data [9]. Despite the fact that online surveys offer an easy way of conducting a research, they may backfire since the main concern is the actual opportunity to conduct a survey anywhere anytime. Distant submission of a questionnaire whose validity is not entirely ensured due to the fact that anybody can fill in a form, seriously questions the truthfulness and authenticity of the same. To prevent such traps, one may utilize several techniques like raising the number of participants or a meticulous filtering of unwanted data; nonetheless, it is still impossible to follow the above mentioned line of thought in case of small number of participants which can easily lead to erroneous research results.

If, on the other hand, we attempt to shed light on the empirical study from a different perspective, we will be forced to realize that traditional measuring is almost exclusively done retrospectively during which the participant records his/her experience about a past activity. For example, if a teacher of informatics gives the instruction to learners to answer some questions related to programming compilation or error debugging. In case of this process, the result is usually recorded only after the task ends, however, learners would have already forgot how they approached the task or solved a programming riddle, i.e. how they came to a valid or an invalid result [11]. Knowing this, every post testing aiming at revealing the behavior and opinion of the participants show a huge contradiction compared to the instantaneous or post feedback hindering the discovery of true data cohesion [10]. Thus, to avoid secondary sources of information, researchers have a tool at their disposition to use web based logging techniques to acquire direct data. Moving in this direction will allow the flow of reliable and objective data in connection with user behavior in

this way opening the perspectives and potentials to the designers of MOOC online courses.

With the rise in number of online education and the development of MOOC's, all the data gathered this way assign a completely new meaning to course design. Big data allow for very exciting changes in the educational field that will revolutionize the way students learn and teachers teach [12].

III. EXPERIENCE PROVIDED BY THE FIRST RECORDED DATA SERIES FROM THE HUNGARIAN COURSES IN VOJVODINA

Within the scope of a project by the Hungarian Academy of Sciences on the use of E-learning tools in nurturing Hungarian talented students in informatics, our research team launched two courses. The first one started on 8 February, 2015 and held the name "Conscious and Safe Internet Use" and involved 100 learners of whom 50 completed the course. The participants had to watch a video that was compiled by the course leader, which combined the techniques of Speaking Head and Desktop Capture, additionally optional learning material was made available so that the learners could hand in three assignments and to be able to fill in the final test. The second one started on 25 February in the same year and intended to introduce to students the basics of PHP programming language. 74 participants made it to the end of the course out of 141 registered learners. Similarly to the previous course, participants used a self made educational video series recorded using the techniques of Desktop Capture. As stated in the requirements of the syllabus, learners had to solve three programming problems that were all evaluated by the course leader [13].

Our main aim with the two courses was to measure, among others, the rate of popularity of the MOOC courses among students (and adults). Previously, we had already discovered that in our region almost every student has some kind of an access to the Internet regardless of the amount of their parents income and can use personal devices (Smart Phone, Tablet, Laptop, Personal Computer) [14]. We intended to investigate if these learners would use such an opportunity for educational purposes as well taking part in an online course, what their results would be , and whether they complete a course.

To proceed with the course, we utilized the Moodle system since it is proven to be a reliable open source and freeware system that provides a huge number of useful tools in order to successfully construct an online course. Taking this platform as a starting point, courses can be created, learners can register and log into the system, tutors and the support stuff can make learning materials available, the course content can be tested, but most importantly, a special program can log online activities in order to obtain measurable statistical data to reveal, for example, learning styles, etc. Participants can always keep contact with each other within the system by sending and receiving messages and taking part in forum discussions. Afterwards, we processed the data recorded by the system, which provided a number of useful information regarding the courses, for instance, learners' points, the amount of time spent in the system, which directories were visited, etc. Data in connection with watching a video was analyzed using the application of the famous video file sharing platform YouTube Analytics, since video files were all embedded into the course material from this site. However, we would have needed more detailed data because this video streaming site provides only global data: the number of video views, the number of views on a particular day, and an estimated value of the total amount of time spent on a particular video.

Based on the instances of useful information, we were able to calculate how well a particular age group performed separating them along genders, what the rate of course abandonment was, how many participants turned inactive after having been registered to the system, how students communicated with each other in the Virtual Learning Environment. We realized that the learners use the technique of just-in-time which means that they watch an educational video and instantly afterwards they send their homework or complete a test.

IV. OUR MEASURE INSTRUMENT FOR THE PILOT COURSES

Based on course design experience prior to writing this paper, I consulted Gábor Kőrösi, a fellow researcher, the Heads of Department Dr. Imre Csanád and Dr. Tamás Németh to give an opinion on the type of data that were needed to be recorded and would contain activities in the virtual environment. The team of the Software Developer Department at the University of Szeged (Gábor Áron Takács, Ferenc Havasi, Dávid Cirok) prepared a Moodle based system which is capable of preparing a log file in which learners activities would be later saved for further evaluation.

The system would be tested with the help of two pilot courses that would last three weeks. The first course was launched on 18.04.2016 and bears the name: Conscious and Safe Internet Use, bringing a field of study to the students of the University of Szeged and to the secondary school students of

Bolyai Secondary Grammar School and Dormitory for Gifted Students, a course that is not intended to be part of the mandatory curriculum. The second pilot course started on 25.04.2016 with the title: Databases, and is part of a regular course at the Department of Information Technologies at the University of Szeged. There were more than 300 000 records in the logging database until 27.04.2016.

The system uses a JavaScript solution that records individual user activities through a (userid), the type of an action, web location and time of the activity.

The following action types were recorded in the Virtual Learning Environment:

- click: which pixel of the display was clicked by the user – the x and y coordinates were recorded in this case. Regarding the tests, we saved the answer option that was chosen and clicked by the user.

- download: which file was downloaded

- character count: every typed character was recorded by the system, also the field where the character was written in (in case of passwords, the characters were not preserved)

- mouse move: mouse movement was recorded in a half minute time interval, namely from the initial coordinates to the target coordinates where the mouse moved, and also the distance. On top of that, scrolling was also tracked.

- navigation: the move from one site to another, login and logout in case of input fields

- in case of video streaming, we recorded the hit on the play and pause buttons both for videos on the private server and on YouTube that were embedded into the learning platform. We also kept track of the changes of time movement in seconds from one part to the other in a video, the switch to fullscreen and back, also the change in the quality of the playback, and sound decrease and increase were all saved

Figure 1. Screenshot of the log data

The method of data mining will be used to process raw data and to acquire new information in order to map learners' behavior and achievement more precisely. We would furthermore classify and make clusters of the participants to later create groups where students would be taught in a more personalized way to create an environment of adaptive learning. We share the expectations of Mark Van Rijmenam according to which Big Data analysis will revolutionize the way students learn and teachers teach [12].

V. CONCLUSION, FUTURE PLANS

Though, many among researchers express doubts regarding Big Data analysis, which is gradually gaining ground, others consider this approach as crucial compared to Henry Ford's ground breaking innovation in the beginning of the 19th century, namely, the system of mass production: „Just as Ford changed the way we made cars, Big Data has emerged a system of knowledge that is already changing the objects of knowledge, while also having the power to inform how we understand human networks and community [4]".

Several big companies and banks try to "fish in troubled waters" in order to point on tendencies, relationships, to name customer clusters, to predict certain behaviours, etc. They are doing so to increase their profits of course. The potentials hidden behind this technique of analysis can be transferred to education as well in order to optimize the process of learning and teaching, to process

more easily the required learning material, and to bring knowledge closer to learners that would be later beneficial for the entire society.

Going through the process of Big Data analysis and revealing its potentials, we came to the conclusion that this system has to be further developed implementing more options to have more sophisticated records of learners' activities. A developed system is capable of recording the users/learners' clicks, mouse movements, character inputs, and detailed information about how a video is used and manipulated by the user.

After evaluating the pilot course, we are going to gather all the system errors, shortcomings that we can observe and reveal. Using the experience from our studies, our intention is to modify the system so that students attending the University of Szeged would be able to sign up for a course which partly contains the learning materials of our pilot, a course which would start from the autumn semester of 2016/2017. This development would enable us to conduct our research among 500-600 students, which would in turn help us gain more precise data by processing Big Data.

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Web Based E-Learning Platforms

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Abstract - A new technology platforms for the education system are create with the development of information technology. Web-based training platforms enable teachers to plan lessons and develop easy to use digital resources to put assessments and tasks and automatically monitor the progress of every student or the entire class.

I. WEB-BASED TRAINING PLATFORMS

Web-based training platforms are integrated software solutions for e-learning. They provide a range of tools for transmitting and acquiring new knowledge, skills and attitudes which aims to encourage and guide the learning process through the use of computer and Internet connection.

Features and functions of Web-based training platforms:

- ensure interaction between trainees and trainers, including communication and exchanging information;

- the possibilities of distribution a materials - publications, organization, and distribution of documents, etc..;

- online access of training "anytime, anywhere";

- online problem solving and receiving an instant evaluation;

- permanent access to materials for the course;

- effective method of evaluation - organizing online tests with individual or group issues and obtain results in real time;

- communication with teachers;

- receiving an errors warning;

- ability to work with other students through e-mail, forums, chat, etc.

Requirements for Web-based training platforms:

- allow the creation of Web-based courses;

- include a means for keeping statistics course and more accurate recording of visits to a site as a whole and in particular of individual teaching units of individual students, the success of the tests of each student, the extent of absorption of the various topics of study material etc.;

- providing opportunity for synchronous and asynchronous communication between teachers and students;

- be made by using free software tools to be cheaper, possibly free, respectively, more accessible;

- does not require great resources on the server side;

- be secured against damage on the disk is installed;

- be protected from unauthorized access;

- allowing quick and easy update;

- does not require any special knowledge and skills in web programming and Web-design by teachers and students;

- is compatible with the most common operating systems and Web-browsers;

- does not require pre-installation of additional software on user stations than standard;

- be universal;

- be compatible with other systems with similar purpose and allow import / export of educational materials [1].

Web-based training platforms can be:

- opensource platforms: MODLE, ILIAS, etc.;

- platforms used by leading schools in the world: Blackboard etc..;

- own work platforms;

- Cloud based eLearning platform.

Learning platforms were traditionally static software-based courses filled with single-source content and at best patchy technology options for collaborating. Today, online-learning platforms are flexible, dynamic and can be accessed on the user's preferred device, including smartphones and tablets. Content can also come from a variety of sources, including crowdsourcing, making the information

more dynamic and varied for learning. Benefits of a Cloud-based eLearning platform:

- No hardware to purchase or maintain;

- No in-house IT staff required;

- Easily expandable;

- Anywhere and anytime access to training;

- Flexible and customizable;

- Protected and secure access.

Google Apps for Education as a Cloud based eLearning platform for training provided by your cloud technologies possibility of organizing WEB-based training. Google Apps for Education (GAFE) is a core suite of productivity applications that Google offers to schools and educational institutions for FREE. These communication and collaboration apps include Gmail, Calendar, Drive, Docs and Sites, and the account unlocks access to dozens of other collaborative tools supported by Google. All of these applications exists completely online (or in the cloud), meaning that all creations can be accessed from any device with an Internet connection. Once a school decides to embrace Google Apps for Education, they can register their school domain (web address), and administer all teacher and student accounts from an administrative dashboard.

Google Docs is an application, which makes file transfers easy for teachers and students.

Google Calendar is an application to track important dates and tasks, always stays synchronized with your phone and Mogget be embedded into a website or blog.

Blogger is a blog application, a combination of software and services for the creation, maintenance and hosting them. From an educational point of view, blogs allow teachers and students to collaborate, share learning resources, create content and connect with major social media channels like YouTube, podcasts, other blogs, tweets, social bookmarks, etc. all on one page [2].

Google Sites is a free platform for creating web pages, which allows free to create Web sites using offered templates. Users need not know the HTML language - the process of creating and editing the site is done by means of a specially developed interface. The main advantage of this application is accessibility. When creating the site is fully working online and no need to install additional programs. Using only the basic functions of the application is free. On each account are available up to 10 GB free web space [3].

Google's platform Classroom,with which all teachers can easily organized in a convenient electronic form learning process, create and check assignments and work of students, the files are automatically structured into folders and documents in the cloud repository Drive for easy access from anywhere. On assignment page students see what the problem is and proceed immediately to its implementation. Implementation data are updated in real time and the teacher can immediately begin checking the work to put evaluations and add comments. Individual assignments are supported. Through Classroom teacher can broadcast of messages and initiate discussions, and the students - to share materials with each other and meet your teacher questions. Now the service Classroom is available in 42 languages and the Bulgarian language, and is optimized for mobile devices and e-book readers. To use the service at classroom.google.com must indicate status (teacher or student), then gets the opportunity to create a new course or join an existing one [4].

The model of web-based career education in technological training (figure 1) using the opportunities provided by "Google Apps for Education" for education..He suggests WEB 2.0 based learning at a mixed type. The educational content for career education is developed like interactive web-based resources.
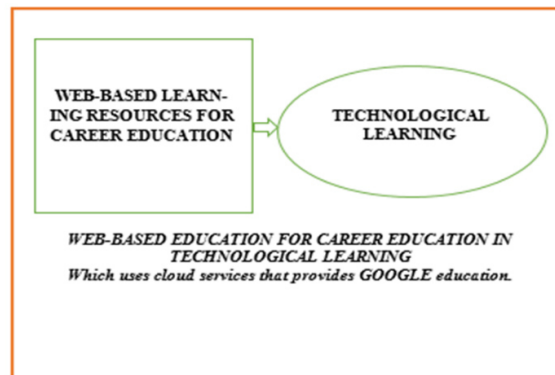
Figure 1. Model of web-based education for career education in technological learning

Students study at their own pace, and communicate with teachers and each other through e-mail, newsgroups, chat and social networks [5].

The model for web-based career education in technological training leverages cloud computing to integrate knowledge for meaningful careers in the field of technological training. To create the Model of web-based job education in technological education for beginning point it is used the model – The Learning Objects of learning. This model is

based on the idea of "learning object" and as such type of object we can understand "every digital resource, which can be used twice to help the learning process" [6]. The proposed model for web-based career education in technological training (Figure 1) using the virtual environment of Google and makes the connection between teaching design and technology.

Cloud computing is a new computing model which is based on the grid computing, it is the core technology of the next generation of network computing platform, especially in the field of education, cloud computing is the basic environment and platform of the future e-learning. It provides secure data storage, convenient internet services and strong computing power. This article mainly focuses on the research of the application of cloud computing in E-learning environment. Taking the

"Google collaborative platform" as a case study, one factor of E-learning environment construction-"the collaborative learning platform" has been built, and also the "collaborative learning" has been given detailed illustration.

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Use of MOODLE in E-Learning for the 2nd Grade of High School

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Abstract - The 21st century is a period of modern technology and globalization which brings quick changes in all aspects of human life. Because education needs to follow modern time, Electronic learning is used increasingly. Moodle is a free program that is often used in e-learning. It is used for mixed learning, distance learning, and for many other projects related to e-learning in schools, universities, workplaces and many other sectors.

This study describes the teaching unit "Creating Presentations," which is discussed in Moodle and adjusted for distance learning.

I.   INTRODUCTION

Very fast development of information technology provides an inexhaustible possibilities of their application in education. Activity of students and individualization of teaching is an important factor in successful overcoming of educational content. The use of electronic technology in the classroom involves the active participation of students, through search, processing and application of new information.

A large number of schools in Serbia is equipped with a digital classroom, a majority of students have a computer and Internet access at home so they can move through the courses according to their own rhythm, interest.

If, for some reason, students are not in school they can learn from home at a time that suits them; teaching content and teachers are available to them 24 hours. This type of learning allows teacher to set up content by various possibilities for students from elementary to advanced levels.

Moodle as a system for e-learning can be a great support for checking and evaluating student achievement. Within the e-learning system with possible interactive communication between students and teachers and students together can be an additional motivation and relief.

Students can post their homework, ask questions and doubts within the forum, chat rooms. Teachers can manage the content for learning, carried out a review of submitted tasks and have an overview of the analysis results.

II.   ADDING A NEW COURSE

On the home page Moodle site on the left side there is a menu of options for administrators. These options are notifications, users, Courses, Reviews, Location, Language Modules, Safety, Appareance, Home page, Server, Networking, Reports . Site administrator can create courses, add user accounts, add speakers, change the role of trainers, create quizzes to test their knowledge, and many other activities.

Creating a course is enabled by pressing the button Add new course. Pressing this button opens the window to add a new course: give the name of the course, a brief description, a short name, ID course, access, many other approaches and course settings.
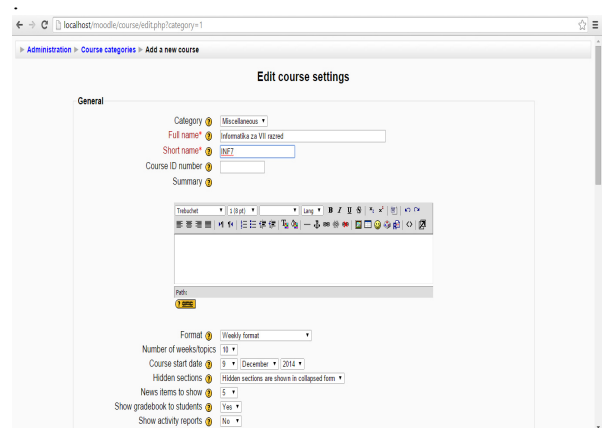
Image 1: Course settings

After completion of the course setup it is necessary to start adding resources. When the button is clicked Turn editing on the top right of the page, the options for editing course content become available. Since the organization is such that courses in Moodle divided into themes, each of the defined themes can be edited in two ways. These are the Add a resource and add an activity. Resources can

be: inscription, text, web pages, links to files or web pages. Activities may include: databases, forum, choice, lessons, chat rooms, Dictionary test, questionnaire, tasks.
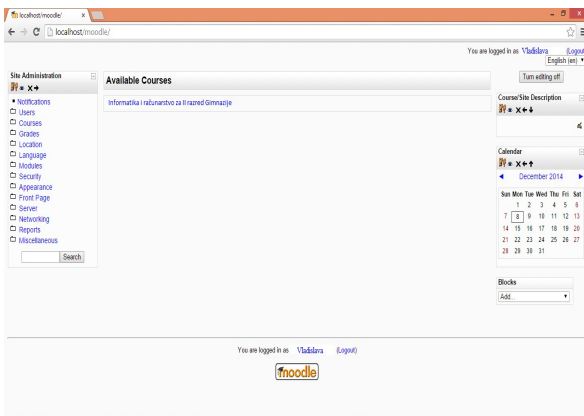
Image 2: Available course for edditing

III. ADDING A NEW RESOURSE TO THE COURSE AND CREATING LESSON

The first unit that will be processed through this course is Cloud Computing. To begin making lesson it is necessary to select the resource, in this case it will be a text page.

Depending on what you want to show you can use other resources to add content, such as pdf file from a computer, or link that will lead the course participants to the certain web page.
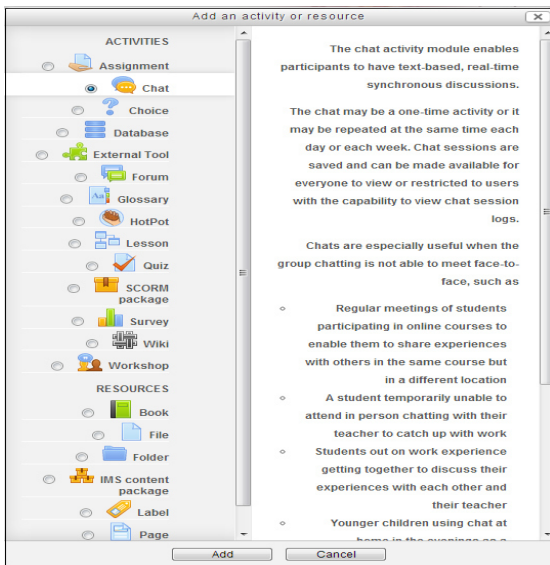
Image 3: Adding a resource

After the text page was added you can complete it, by adding text content, images and other elements which are related to the lesson. The lesson can contain one or more text pages. Appearance of lesson Cloud Computing is shown on image 4. Each

of these pages contains the text content that processes the appropriate topic.
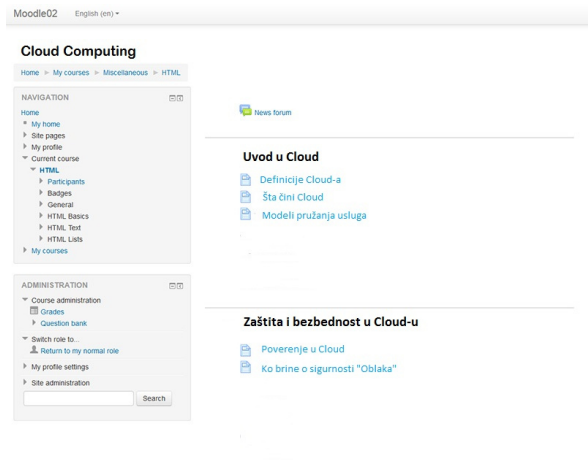
Image 4: Lesson Interface

At the end of each course, it is necessary to add a quiz which can be composed of several different forms of questions.

IV. CREATING A QUIZ IN MOODLE

The very first step in creating a Moodle quiz, is going to: Add an activity or resource>Quiz. If you don't see this, you should be able to use the dropdown Add an activity>Quiz. Now you should be able to access the following fields under Quiz Settings. First you should give the quiy name and description. After that you should manage date settings, and grade settings if you want to. When you set up all settings you have to add questions to your quiz. First you shoud choose a question type to add.
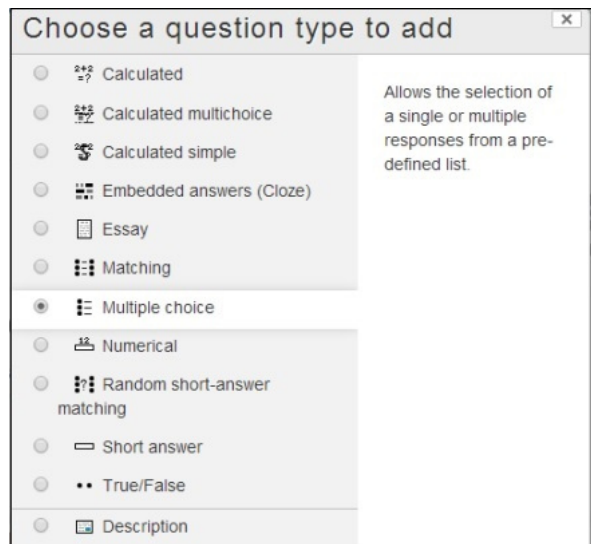
Image 5: Adding a question to quiz

There will be a question form on the next screen, where you can put in your question, as well as the grade you wish to give the correct answer. Add responses and feedback that will be displayed when students give a certain answer. For example, if question is correct – "That's right!" If the answer is wrong, the correct response can be given. Add responses and feedback that will be displayed when students give a certain answer. For example, if question is correct – "That's right!" If the answer is wrong, the correct response can be given.

V. How can Students use the Course

This course is designed for students of II grade of high school for online learning a lesson Cloud Computing. Moodle course is designed to students which can be able to access the course and repeat the lessons which are learned, and to access the Quiz and check the percentage of the learned material. The greatest use of this Moodle course for distance learning, when students are not there during the classes Also they can follow courses for all others units. Beside monitoring units, students can follow the news, use chat rooms, exchange experience and learn together .

Lessons contain links to sites where students can further learn more regarding this topic. Students can access the course by logging in as guests. They enter username and password and can access the course for 24 hours, and deal with the tests but do not have the possibility to change the content. While on the other side teacher is administrator and only he or she can make changes.

VI. Conclusion

Moodle is a revolutionary way of learning. The sense of Moodle is an active and creative learning process just the way it is, and the software was created and it continues to develop and upgrade. Such interactive teaching meets the requirements of modern teaching in which learning is not just "consuming" content, but takes place through cooperation and creation of their own content. In this way the information-communication-technology is used as a supplement to traditional learning and creates the so-called Open School in which active learning by interacting with teachers and students will contribute to faster development of a positive attitude towards learning.

Moodle is the most famous e-learning software around the world who simply create dynamic applications for learning. Also, the software is completely free and under constant improvement so it is adaptable to all customer requirements.

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Different Aspects of Big Data Usage in Education

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Abstract - The importance of big data in today's business analysis and other fields is rapidly being transferred to education as well. These data, gathered from different sources, may be analyzed computationally to reveal patterns, trends, and associations of student and teacher behavior, and used in various aspects of teaching and learning. This paper will present some of the ways this data can be used to improve student performance and raise teacher/professor effectiveness.

I.   INTRODUCTION

In recent years we have witnessed a dramatic increase in our ability to collect data from various sensors, devices, in different formats, from independent or connected applications. This data flood has outpaced our capability to process, analyze, store and understand these datasets.

Business intelligence and analytics and the related field of big data analytics have become increasingly important in both the academic and the business communities over the past two decades. Industry studies have highlighted this significant development. For example, based on a survey of over 4,000 information technology professionals from 93 countries and 25 industries, the IBM Tech Trends Report (2011) identified business analytics as one of the four major technology trends in the 2010s. In a survey of the state of business analytics by Bloomberg Businessweek (2011), 97 percent of companies with revenues exceeding $100 million were found to use some form of business analytics. A report by the McKinsey Global Institute (Manyika et al. 2011) predicted that by 2018, the United States alone will face a shortage of 140,000 to 190,000 people with deep analytical skills, as well as a shortfall of 1.5 million data-savvy managers with the know-how to analyze big data to make effective decisions [1].

Such Big Data analysis now drives nearly every aspect of our modern society, including mobile services, retail, manufacturing, financial services, life sciences, and physical sciences. What is of interest for this paper is increase in Big data usage in education, so explanation of the term and some benefits in different areas of education will be described.

II.   WHAT IS BIG DATA?

The term 'Big Data' appeared for the first time in 1998 in a Silicon Graphics (SGI) slide deck by John Mashey with the title of "Big Data and the Next Wave of InfraStress". Big Data mining was very relevant from the beginning, as the first book mentioning 'Big Data' is a data mining book that appeared also in 1998 by Weiss and Indrukya. However, the first academic paper with the words 'Big Data' in the title appeared a bit later in 2000 in a paper by Diebold. The origin of the term 'Big Data' is due to the fact that we are creating a huge amount of data every day [3].

Big data is high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation.

Doug Laney was the first one to talk about 3 V's in Big Data management:

- Volume: there is more data than ever before, its size continues increasing, but not the percent of data that our tools can process;

- Variety: there are many different types of data, as text, sensor data, audio, video, graph, and more ;

- Velocity: data is arriving continuously as streams of data, and we are interested in obtaining useful information from it in real time.

Nowadays, there are two more V's:

- Variability: there are changes in the structure of the data and how users want to interpret that data;

- Value: business value that gives organization a compelling advantage, due to the ability of making decisions based in answering questions that were previously considered beyond reach.

There are many applications of Big Data, for example the following [4]:

- Business: costumer personalization, churn detection;

- Technology: reducing process time from hours to seconds;

- Health: mining DNA of each person, to discover, monitor and improve health aspects of every one;

- Smart cities: cities focused on sustainable economic development and high quality of life, with wise management of natural resources.

These applications will allow people to have better services, better costumer experiences, and also be healthier, as personal data will permit to prevent and detect illness much earlier than before. At last, presence of big data in education is rapidly changing the teaching and learning environment.

III. BIG DATA IN EDUCATION

Data and analytics are increasingly being used by forward-thinking teachers and school administrators to gain an overview of how the provision of services is going in their districts. In Wisconsin's Menomonee Falls School District, data has been put to use for everything from improving classroom cleanliness to planning school bus routes, after department leaders were encouraged to attend classes themselves on how to gain insights from data and analytics [4].

Products and services are coming onto the market to automate many processes based on big data analytics. Eduvant, for example, is a tool that allows teachers and school administrators to get everything from an overview of the school's performance around academic achievement and discipline, to warnings when an individual pupil's learning is not progressing as expected.

One U.S. middle school found that the number of pupils being sent to the principal's office for disciplinary reasons had grown very much. After examining the data, they realized that this happened at the same time when excursions such as ice skating and sledding trips were canceled. When these were reinstated, behavior among students improved, leading to a noticeable reduction in the number being sent to see the principal.

With hundreds of students to monitor, in the past it may have been difficult for teachers to identify which pupils were in need of an extra helping hand, and many of these decisions may have been based on gut feeling. In the past, the first sign that a pupil was in danger of failing might have been when he scored poorly on a test. A data-based approach to ongoing analysis and assessment of individual students' achievements means that more personalized learning can be delivered – taking each student's individual interests, prior knowledge, and level of academic ability into account.

Schools are also finding themselves armed with new technologies aimed at cutting down on exam cheating and plagiarism among students. The Proctortrack system aims to prevent cheating by using webcams and microphones to monitoring students while they sit for online exams. By building profiles of cheating behavior, it is able to recognize and flag suspicious activity. Proctortrack uses facial recognition to ensure that the correct student is taking the test, monitors computer activity to make sure that unauthorized sources aren't being consulted, and even tracks eyeball movement during the assessment.

The Massively Online Open Courses (MOOCs), which deliver all of the learning materials and exams via a computer or tablet, are providing a wealth of insights into the ways that people learn. Harvard University has recently developed tools that allow data gathered from these courses to be examined in real time. Data from the millions of people around the world who take these courses (and the far smaller number that actually complete them) can be analyzed to find the stumbling blocks that cause learners to fail.

LectureTools, developed by a Michigan University professor who realized this problem, was sold to educational software specialists Echo360. It allows students to follow lecture presentations on their laptops, annotating them as they go along. It also lets them ask anonymous questions while the talk is in progress, which flashes up on the lecturer's screen. This makes it easier for students who may be embarrassed about speaking in public or their lack of understanding to engage rather than "switching off" and failing to learn. The system also includes an "I'm confused" button. Lecturers can look at usage statistics for all of these features and use it to fine-tune their delivery and engage with students when individual attention is required.

Other services, such as Knewton, offer personalized learning that can be offered in or out of a classroom. Analytics are used to determine the best approach to teaching each student, and each of them are assessed alongside the millions of others using the system. Machine-learning algorithms then tailor each course to deliver "adaptive learning" based on the individual's strength, weaknesses, and preferences.

Knewton's adaptive learning platform draws on decades of research into psychometrics, item response theory, cognitive learning theory, and intelligent tutoring systems. It measures student understanding of every concept, and defines the relationship between those concepts to provide a framework for student learning. At Knewton, they divide educational data into five types:

- Identity Data: Who are you? Are you allowed to use this application? What admin rights do you have? What district are you in? How about demographic info?

- User Interaction Data: User interaction data includes engagement metrics, click rate, page views, bounce rate, etc. These metrics have long been the cornerstone of internet optimization for consumer web companies, which use them to improve user experience and retention. This is the easiest to collect of the data sets that affect student outcomes. Everyone who creates an online app can and should get this for themselves.

- Inferred Content Data: How well does a piece of content "perform" across a group, or for any one subgroup, of students? What measurable student proficiency gains result when a certain type of student interacts with a certain piece of content? How well does a question actually assess what it intends to?

    Efficacy data on instructional materials isn't easy to generate — it requires algorithmically normed assessment items. However it's possible now for even small companies to "norm" small quantities of items. Then, by splitting up instructional content and measuring (via the normed items) the resulting student proficiency gains of students using each pool, it's possible to tease out differences in content efficacy.

- System-Wide Data: Rosters, grades, disciplinary records, and attendance information are all examples of system-wide data. Assuming you have permission (e.g. you're a teacher or principal), this information is easy to acquire locally for a class or school. But it isn't very helpful at small scale because there is so little of it on a per-student basis.

    At very large scale it becomes more useful, and inferences that may help inform system-wide recommendations can be teased out. But even a lot of these inferences are tautological (e.g. "if we improve system-wide student attendance rates we boost learning outcomes"); unreliable (because they hopelessly muddle correlation and causation); or unactionable (because they point to known, societal problems that no one knows how to solve). So these data sets — which are extremely wide but also extremely shallow on a per-student basis — should only be used with many grains of salt.

- Inferred Student Data: Exactly what concepts does a student know, at exactly what percentile of proficiency? Was an incorrect answer due to a lack of proficiency, or forgetfulness, or distraction, or a poorly worded question, or something else altogether? What is the probability that a student will pass next week's quiz, and what can she do right this moment to increase it?

The ability to access, analyze, and manage vast volumes of data while rapidly evolving the Information Architecture has long been a goal at many Higher Education institutions.

Many have long standing data warehouses and have used analytics tools. As the competition for gifted students becomes more intense while the cost of education makes the pool of potential students more limited, many institutions are taking another look at how they are analyzing potential students and managing the experience that students have while they are enrolled. Analytics play a critical role in performing a thorough analysis of student and learning data to make an informed decision on future course offerings and their mix to cater to the potential and existing students.

While there are well-founded reasons to take privacy and data security seriously, particularly when it comes to education, it's equally important to ensure that education is delivered in the most effective way possible. Big data has the power to enable schools to run more efficiently, to enable teachers to impart knowledge more effectively, and to ensure that fewer children slip through the net, failing to have their educational needs met.

IV. CONCLUSION

Big Data is going to continue growing during the next years, and each data scientist will have to manage much more amount of data every year. This data is going to be more diverse, larger, and faster.

We have entered an era of Big Data. Through better analysis of the large volumes of data that are becoming available, there is the potential for making faster advances in many scientific disciplines and improving the profitability and success of many enterprises.

Big Data has the potential to revolutionize not just research, but also education. A recent detailed quantitative comparison of different approaches taken by 35 charter schools in NYC has found that one of the top five policies correlated with measurable academic effectiveness was the use of data to guide instruction [4]. Imagine a world in which we have access to a huge database where we collect every detailed measure of every student's academic performance. This data could be used to design the most effective approaches to education, starting from reading, writing, and math, to advanced, college-level, courses. We are far from having access to such data, but there are powerful trends in this direction. In particular, there is a strong trend for massive Web deployment of educational activities, and this will generate an increasingly large amount of detailed data about students' performance.

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E-learning

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Abstract – This paper, after a brief introduction on e-learning, its advantages and disadvantages, presents a case of using e-learning at the Technical School from Kikinda. The course was created through Moodle, and it was realized in two languages: Serbian and Hungarian. This paper describes the experience of users.

I. INTRODUCTION

The time in which we live and the jobs that we do require a lot of things from us, such as skills, fast learning, quick adjustment, keep up the world. Nowadays, jobs that require knowledge are becoming scarce. Newer jobs require knowledge renewal, upgrading skills, continuous improvement. With the development of information technology, education is not limited to the mandatory, but individuals looking to develop in every way, they want to learn as much as possible. The answer to these needs is E-learning, which is getting more popular in the world. E-learning brings with it many advantages. The introduction of this term is the growing role of the teacher as a mentor. The role of teachers in this process changed but it is still crucial. E-learning enables the center of the learning process is the student who takes an active role and responsibility for its results. The development of E-learning in the world pays huge and very significant attention.

II. BACKGROUND

The originator of distance learning was Isaac Pitman, a teacher of shorthand, which is their way of communicating with students overcome physical distance in order to convey knowledge. In Britain in 1840, Isaac Pitman with your students around the country and well communicated to them transmitted knowledge. Students were asked to transcribe short messages from the Bible and to return via the same mail message. This way of learning is demonstrated qualitative, economical, pragmatic side as compared to traditional learning. The conclusion is that at the beginning of the development of distance learning used the postal system, providing opportunity to all, regardless of the reasons for the continued presence of the inability to acquire knowledge. Start of distance education at the university level took place in the US in 90-ies of the 19th century, by

correspondently studies. The first real revolution actually took place in the mid-80s of the 20th century with the advent of multimedia systems. The next step is achieved with the use of the Internet. Before computers became available, the traditional view has been the primary form of acquiring knowledge. This type of learning required a certain amount of time for the talk, which also often means a lot of duties, high cost of learning and inability to leave at certain times. All this has prompted experts to seek new solutions. In an attempt to make learning accessible and visually advanced courses aimed at teaching with computers began to be delivered on CD-ROM. Availability rates led to savings of time and money, but the lack of interaction with the professor had consequences, but it is slow the progression of students. WEB development of space education institutions increasingly began to use this technology. They begin to use free forms of mentoring via e-mail, the Internet, with the help of Web graphics and text.

In the 21st century, learning under the supervision of trainers, through web and can be combined with mentorship in real time and with facilities that should awaken curiosity. New technologies have enabled the creation of highly effective learning environment, reducing the cost of learning and setting new standards for e-learning. Acceptance of the need for further development of e-learning is confirmed by the fact that the world today has more than 150 million on-line students. Participants are growing day by day and this should be kept in mind [1]

III. THE TERM E-LEARNING

The term "e-learning" is one of many terms with the prefix "e", which has recently been mentioned in many daily newspapers, journals, technical books. In all terms (e-learning, e-health, e-government, e-mail, e-banking, e-commerce,) indicates the performance of certain activities with the help of information and communication technology (ICT). There are various definitions of e-learning; they usually depend on the profession and experiences that people have. These definitions can be classified into two groups:

- A group of "technical" definition places the emphasis on technology (the "e" part of the name). An example of one of the "technical" definition is: "E-learning is any form of learning, teaching and education that is supported by the use of computer technology, especially computer networks based on Internet technology." [2]

- A group of "teaching" definition has an emphasis on education that is at learning and teaching. One such definition is: "E-learning is interactive or two-way process between teachers and students with the help of electronic media with emphasis on the learning process while the media only adjuvant that completes the process." [2]

Today, the education process is inconceivable without the use of personal computers. Improvements in computer development and ICT, with the capabilities they provide, have been created entirely new conditions of education. The classic form of teaching to modernize various forms of e-learning, electronic textbooks are used, I realized courses online assessment tests, created a virtual laboratories as well as laboratories with remote access. [3]

IV. E-LEARNING VERSUS TRADITIONAL

Quality of work traditional schools cannot sufficiently meet the needs of modern society. Modern society requires the individual to independently collect information that manages, analyzes and converts them into usable knowledge. Support traditional educational process using the Internet and multimedia technologies for application in our conditions is very important, because the system of traditional elementary education in Serbia largely based on concepts from the last century, with a very low degree of adjustment of teaching individual characteristics and abilities of students. Application of modern information technology in support of the traditional educational process in our conditions can, at this point to make a major result from the application of full remote education. In order to realize the existing potential of distance education must realize that it is much more than a simple combination of innovative technologies for knowledge transfer. In introducing information and communication technologies in education is necessary to: take into account individual differences, allow more capable and more prior knowledge to make faster progress and know that the machine can perform a task well, only if it is inserted in a good program. It can be concluded that education must respond to change and to become more efficient.

V. VIRTUAL ENVIRONMENT

To be on the computer network implemented stimulating virtual learning environment, designed software that allows us to make and keep educated multimedia materials in electronic form, individually delivering these materials to students. All learning outcomes must be for each student to record in a database to track and analyze the flow of learning. Communication between teachers and students is done through e-mail or through social networks where they can exchange opinions or establish the group and work within it with all students. This controlled system of learning that works well stimulating learning environment called LMS (Learning Management System). A good system has to support IMS standards and rules to learn. [2]

Virtual learning environment VLE (Virtual Learning Environments) systems are used to assist trainers in conducting classes. System to monitor the process of the students and is also available on the teacher and the student. VLE mainly serves as an aid for teaching "face to face".

Before the advent of standards in this area was a different situation. Manufacturers have been forced to make several versions of the materials in order to be able to cover multiple systems. If the materials were made at a college, then they might not be used on another. This significantly increases the cost and allows sharing of materials between the educational institutions. Standards need to be defined and to conclude before being accepted by the manufacturer for learning and policy materials.

VI. THE ADVANTAGES OF E-LEARNING

- E-learning enables all users to participate in class when it comes to distance, and when it is practically not possible. Very wide availability enables the simultaneous participation of a large number of users.

- The interaction between professors and students is done via computer. This interaction is often immediate and intensive than live communication; questions can be entered without fear of authority professors.

- Using interactive learning content and different media (text, images, sound, video, animation, simulation) for presenting content and availability 24/7 online content. Facilities for learning can be tailored to individual students, for example, can be added amenities for those with lower level of prior knowledge, as well as for advanced students who want to learn more.

- Participation in the prestigious and quality programs - the student can attend some courses at institutions without a change of residence.

VII.   DISADVANTAGES OF E-LEARNING

- The biggest problems with the e-learning are that it is difficult to motivate the student to enroll in the online course or program, to actively participate in its execution and successfully complete it and depending on the technology, in addition to being too long and making themselves electronic content for learning.

- E-learning required by certain knowledge and skills to be able to use. Without computer literacy materials within the e-learning becomes completely useless. In addition to knowledge, to conduct e-learning users must include specific equipment.

- Not the highest quality equipment that the user can possess is not 100% reliable. When technical problems disrupt classes, this may contribute to a decline in the concentration of students, and to the decline in the quality of e-learning.

VIII.   EXAMPLE OF E-LEARNING

Moodle is a free platform for e-learning. The creator of Moodle is Martin Dougiamas. Internationalization of websites based on this platform adds to its popularity, so users can use it in their native language. Currently Moodle localized into over 100 languages in 193 countries. Technical school in Kikinda includes e-learning, which allows students effective learning. Currently used by Moodle with version 2.9, but in a few weeks will move to the latest version, 3.0. Technical school has many courses that are divided by area, Electrical engineering, mechanical engineering and metalworking, transportation, general subjects, student support and motivation to the students completed a particular course, and of course the manual for teachers who have not used this platform. Registered users have access to all content courses while guests (guest) available just a few courses. In addition to the courses there is also a calendar, schedule, members who are currently online. On completion of the test result and instantly receive depending on the administrator can re-do the test.

The site is provided in 2 languages, in Serbian and Hungarian language.

Figure 1.   An example of a school site in Serbian language

Figure 2.   Website Technical School in Hungarian

A pair of students said the following:

I pupil:

Website Technical School is a good example of a real school site where we can find whatever we need.

If someone, for example, wants to establish and verify their knowledge, or was not present at the time for some reason, at home on the computer, mobile, tablet can access the E-set.

E -teaching is very easy to use, can be used with or without registration.

It may be used by all students of the school, as well as other users.

You can find courses for various programs that are explained in detail, how the assignments for both regular and part-time pupils.

The students of the Technical School can work tests and exercises on the site.

On the site there is a section "Transport" where you can learn everything from motor vehicles to regulate the traffic safety and practical training.

There's even support for the students, how to motivate yourself to learn.

In my opinion the site should be added to pictures and videos and use these applications / programs and in practice.

II pupil:

I think that Moodle should constantly be improving and that a lot more work on it, to use easier and more interesting.

III pupil:

E-learning allows us to distance learning. A student at home can practice and through some interesting examples teach many things. One of the advantages of Moodle is that the professor can simply hang a lesson, you should not write it down.

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Semantic Annotation of E-learning Materials on Mobile Platforms

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Abstract - This paper describes an e-learning approach based on the concept of finding relations between the notions in the learning materials. Discussed system is a part of DSi (Drag and Drop Semantic Interface) framework for semantic enhancement of textual lessons. It represents new branch of DSi development that is focused on using this concept of learning on mobile phones and tablets (touch devices). The aim of the project described in this paper is web application optimized for mobile devices that will enable users to get relations between two notions by dragging and dropping one onto another. It is crucial that drag-and-drop functionality work well on variety of mobile devices and that application layout is adequate for different screen sizes. This paper describes the need for creating optimized version of this framework for touch devices. Brief overview of system is given and also the layout of the application on different screen sizes is shown.

I. INTRODUCTION

In this paper we present an e-learning approach that uses additional semantic layer for enhancing learning materials with additional knowledge. [1] [2] This project is focused on developing an e-learning tool for mobile platforms and it is a follow-up of DSi framework development. Aim of this project named DSi Mobile is to give students possibility of learning on their mobile phones or tablets on the go. Focus is put on creating application with layout that is adaptable to variety of devices and screen sizes. Defined relations between relevant notions are accessible to students by using drag-and-drop functionality.

Delivering teaching materials to students using technology for transferring knowledge is basis of E-learning. Also it is necessary to enable individualized and dynamic approach to creation of learning materials. Distribution of teaching materials on demand, in time when it is needed and in quantity needed represents the base of e-learning. DSi focuses on enabling student to extract additional knowledge from learning materials given in textual format. It consists of semantic and textual layer, and on user demand (drag-and-drop action) system delivers relations from semantic knowledge-base to user. With this project authors wants to give the

possibility of using this concept on any device with internet access. So far this concept was developed for usage from desktop computers and laptops.

In past few years web has become more accessible by portable and wireless devices (mobile phones, tablets, etc.). ITU (International Telecommunication Union) report from 2010 stated that with current rates of mobile access growth, web access from these types of devices (smart mobile devices) is likely to exceed web access from desktop computers within the next five years. And in January 2014 the time of mobile access to the internet exceeded desktop use in the USA. Web access shifting from desktop to mobile has been accelerating since 2007 with the appearance of larger multi-touch smartphones, and the rise of multi-touch tablet computers since 2010. Both of these platforms provide better internet access, bigger multi-touch screens and mobile browsers (application-based user web experience). [3] Considering this next logical step in DSi development is expanding its usage on mobile web.

Further in the paper we will briefly describe what are disadvantages of current DSi version regarding mobile web usage, and one possible solution to this problem will be proposed. Furthermore, implemented system will be described and new user interface for mobile platforms will be shown. Also comparison of new layout on different devices will be given.

II. DSI PROBLEM ON DEVICES WITH TOUCH SCREENS

A. Currently developed versions

Until now several versions of the DSi tool have been developed. First version (1.0 and 1.5) [4] [5] provides one-way communtication with the user (extracting relations from learning materials) [6], whereas in second version two-way communication is enabled (it is now possible to define new relations using DSi). [7] [8] Also a system for testing DSi

concept in university learning conditions has been developed (designed for monitoring and recording all user actions while using DSi). [9] Also authors explored the posibility of using this concept in students knowledge assessment by developing DSi assessment tool. This tool enables creation of individualized test with questions that are formed depending on semantic relations kept in semantic documents. [10]

B.   Problems detected on touch screen devices

DSi has been designed as a Web application for use on desktop computers and laptops. When user starts the application from mobile browser on a smartphone or a tablet the representation is not adequate. The display size of the mobile phone or tablet is smaller so the application looks miniature. The current design does not provide resizing of the application to fit the screen of mobile devices. The user can zoom-in the page. If he resizes the page he would be forced to constantly shift the page left and right. In this way user loses focus from learning of the lesson presented. Using application on this way it is not possible to see entire lesson on display, so that means more time necessary for reading/learning. We can make a conclusion that on this way students waste more time than they would earn by using drag-and-drop functionality.

Figure 1. The DSi 1.5 appearance on mobile browser (LG Optimus G, 4.7 inch smartphone)

DSi is designed as a concept of learning by dragging and dropping one notion onto another. This is the primary way of getting the additional knowledge about the relation between notions in the text. DSi interface has been designed in a way that enables users to drag-and-drop notions on each other and get information about the lesson that are not implicitly mentioned in the text. Drag-and-drop

functionality implemented in current version does not work well on mobile browser. This functionality has been implemented as an action by using a computer mouse. But on mobile devices this functionality must be implemented with toe work with touch action. On the figure 1 it is shown the representation of the application for the desktop computer that has been opened in a mobile browser.

III.   PROPOSED SOLUTION

A.   DSi Mobile web app with responsive design

Main goal of the project described in this paper is to enable use of DSi tool on the latest generation of mobile phones and tablets with touch screens. Taking into account all the shortcomings of the current version it is necessary to find adequate solution. There are two possible courses in which development of the application can go. First option is to create mobile version of the DSi web application, and the second is to create mobile applications for the popular operating systems on mobile devices. First approach gives us the possibility of keeping current architecture of the application. Also when we develop mobile web application it will be adaptable to variety of devices and screen sizes. It is necessary to change the client side of application and a very small part of server side logic. Communication logic between server and client would stay unchanged. Changing client side is necessary for enabling the web page to adapt to different screen sizes of mobile devices. The second possibility is implementing mobile applications for popular operating systems on mobile phones (Android, iOS, etc.). In order to do this, we would need recreate architecture for every new application on different mobile platform.

The main mobile DSi version development directions were defined after taking all advantages and disadvantages of both approaches. Although mobile phones are using different operating systems, mobile web site adapts to every phone and display size. Responsive web design is technique for developing web sites adaptable for variety of devices and screen sizes, such as desktop computers, mobile phones, tablets, etc.

Responsive web design focuses on simplicity. Basic idea is creating web page which would adapt its representation to fit any screen size, whether it is a laptop, mobile phone or a tablet. Responsive web sites are developed using flexible design. Depending on the size of the screen content of the page is scaled. Pages are responsive if they are adaptable to the devices screen size. Regardless of which device is used for browsing responsive pages provide us

with good user experience. Instead of developing multiple versions of mobile web pages for different screen sizes, if we use responsive techniques, pages will automatically adjust its content to fit the screen size of the device. For developing DSi Mobile application JQuery Mobile framework is used. It is based on HTML 5 user interface and it is designed for developing responsive Web sites and application which are available on all smartphones, tablets and desktop computers.

B.   User experience on touch devices

For the purpose of this project authors created demo application [11]. In this version there are two modes of using DSi: read and edit.

Read mode is created as a subsystem for learning. Users first need to log on to the system after which they are redirected to the welcome page with the instruction of how to use the system. After reading the instructions they can start learning process. Prepared lesson is shown to the users. Semantic layer enables enhancement of the learning materials with additional knowledge, relations between key notions in the text. Notions are specifically marked in the text with grey color and have enabled drag-and-drop functionality. Idea is that users can get additional information that is not explicitly mentioned in the lesson simply by crossing two notions. System is designed with the possibility of tracking and recording user actions through the entire learning process. If it is necessary learning session can be limited by specifying the time for learning.

Edit mode represents subsystem for creating semantic documents necessary for learning. This part of the system intended for domain experts to use. It is designed for teachers (people with enough knowledge in the area of science for which lesson are prepared). They are presented with the lesson page in which all words are draggable. Defining new relation is done by dragging and dropping one notion onto another and entering relation between those notions in the form presented. Relation is then sent to server and saved in the semantic document. This document is then used as a semantic layer for lessons presented to students.

C.   Comparison of user experience on different touch devices and screen sizes

DSi mobile web application has been tested on various mobile devices. Further in the paper it will be shown the representation of the mobile application layout on the LG Optimus G e975 smartphone (4.7 inches) and Lenovo MIIX 3-1030 tablet (10.1 inches). On figure 2 and 3 it is shown

the appearance of the application in portrait and landscape orientation mode on LG optimus G, respectively.

Figure 2. The DSi Mobile appearance on LG Optimus G, read mode, portrait orientation mode
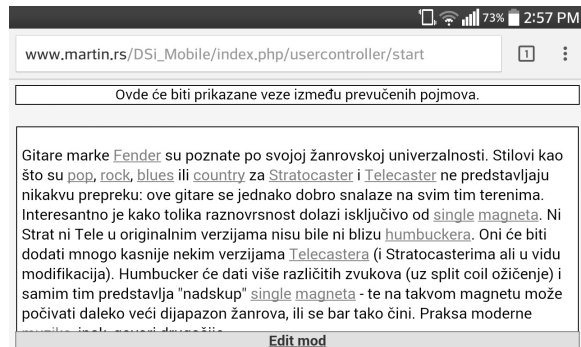
Figure 3. The DSi Mobile appearance on LG Optimus G, read mode, landscape orientation mode

And on figures 4 and 5 it is shown the appearance of the application in portrait and landscape orientation mode on Lenovo MIIX 3-1030, respectively. As it can be seen this user interface adapts to any screen size and device orientation.
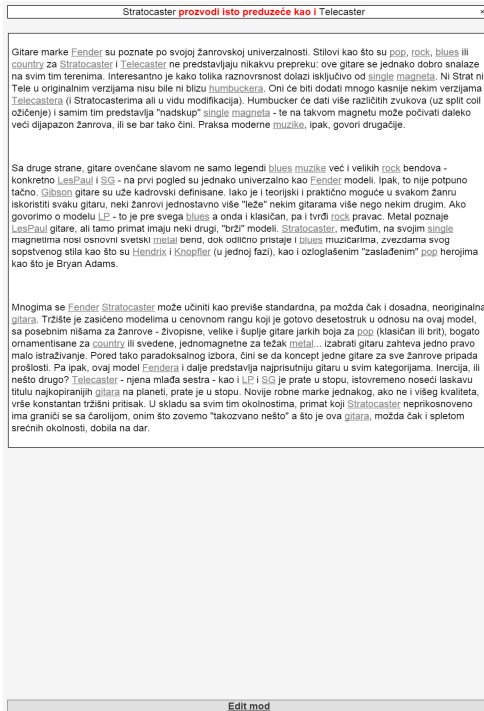
Figure 4. The DSi Mobile appearance on Lenovo MIIX 3-1030, read
mode, portrait orientation mode
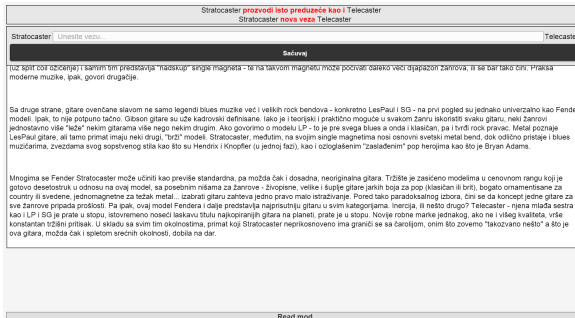
Figure 5. The DSi Mobile appearance on Lenovo MIIX 3-1030, edit
mode, landscape orientation mode

IV. CONCLUSION

In this paper authors presented e-learning tool developed for usage on mobile platforms. This framework is folow-up of existing DSi e-learning framework, and it is being developed at the Faculty of Electronic Engineering Niš. Disadvantages of current version regarding its usage on mobile devices are discussed. Furthermore, authors discuss posibilities of further application development and propose one solution to problem observed.

Implemented mobile web application with user interface adaptable to all mobile devices and screen sizes is shown. And user experience is described in detail. Comparison of application layout on different devices and screen sizes is shown. Further research may include development of system for testing this version in real university conditions of learning. The idea to be able to conduct research with two or four groups of students. They will be introduced with the few prepared lessons (for which semantic document are created) and the possibility of switching between lessons, within the time given. Also to some of them DSi drag-and-drop functionality will be enabled. It would be necessary to have all this action recorded for further analyses.

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Independent Learning and Modern Educational Technology

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Abstract. This paper points at the importance of educating young people for qualitative information usage from the Internet. The review of abilities and skills incorporated in information literacy is presented, which helps in illustrating the role of independent learning skills in this type of literacy. Independent learning skills, e-learning, distance learning as well as life-long learning is all based on information literacy. Electronic learning (e-learning) and distance learning (UND) enable users to attend some of the offered educational courses that can be found on web sites of educational institutions. The review of distance learning, a forerunner of web oriented learning, is presented as well. It is also described a development process of contemporary educational technology which follows this type of learning. Finally, the most important notions related to distance learning and modern information technologies are explained as well.

I. INTRODUCTION

The Internet has introduced new terms for learning, learning via web, or online learning. Online learning is classified as a general term, related to learning by the help of a computer and the Internet. The levels of such learning are various, starting from basic programs that include texts and the course graphics, exercises, tests and tests results. Some of them include animations, simulations, audio and video sequences of discussion groups with peers and experts, online tutorial, links for materials on the Internet or web as well as other educational resources (Urdan & Weggen, 2000).

Together with online learning the term online education has also been made. Online education enables studying advanced education courses via the Internet. All course materials including documents, contacts with tutors and colleagues may be accessed via personal computers and telecommunications.

Online education offers students freedom to study virtually in any location and in tempo which could be adjusted to their own conditions, work and families (Kearsley, 1999).

Close terms to online learning are Web-based learning and technology-based learning. The use of terms e-learning and e-aided learning is appropriate nowadays. There are different definitions of such learning. The shortest definition was given by English Ministry of Education and Skills in 2003: "If someone learns how to use information and communication technology, he uses electronic learning"(DfES, 2003).

Electronic learning assumes learning in which computer web is used for information distribution, interaction and improvement of the learning process. Here, different computer webs, such as LAN, WAN or the Internet can be used, as well as audio and video tapes, satellite broadcasting, interactive TV and CD-ROM and mobile network. Within the learning based on new technologies it is important to mention resource-based learning, too. This term has become popular partially because it reflects new trends and progress and because it serves as a concept which covers the terms such as open learning, flexible learning, individual learning, and computer aided learning and project based learning.

Time and location independence, great volume of resources and dynamic contents nature have made the Internet a great potential for learning.

Students who acquire knowledge at universities all over the world have already had certain subjects which they study via the Internet, or online. Most employed people, as well as those who live far from universities enroll online courses organized by universities and colleges. [2]

Because of fast development of technologies the accepted concept of adults' education and permanent lifelong learning represents one more element that supports the necessity for implementation of a modern way of distance learning.

Distance learning according to definition of "United States Distance Learning Association" (USDLA): "Distance learning is assimilation of knowledge and skills through indirect methods of informing and education comprised by various

technological and other types of distance learning." [7]

Some authors have defined distance learning from technological aspect:

"Distance learning is a system and a process of connecting users with distributed educational resources. In order to understand the current potentials of distance learning it is necessary to comprehend that it represents much more than simple combination of innovative technologies for knowledge transfer. Before introducing information communicative technologies in education it is necessary to: accept individual differences, let more capable users with previously assimilated knowledge to make progress faster and understand that a machine can perform the task well only if a good program is made. We may conclude that education must respond to changes and become more efficient". [5]

II. PROGRAMS AND COURSES

Education, traditional or based on Web, involves the work of experts for organizing contents, sequences of teaching activities, the structure of tasks, a set of interactions and the process of evaluation. (Harasim and others,1995).

The course which is designed or adopted to be delivered via Web is delivered to different surroundings from a traditional classroom and because of that the designed process imposes respecting the following pedagogical steps, including the need for:

- changing the role of an instructor going from a teacher to an assistant or a process guide,
- leading students through non-linear, hypermedia surroundings which enables making knowledge and meaning in a new way,
- building feelings for class community and strengthening learning by building-in collaborative elements,
- Providing an academic integrity.

Virtual classroom is a medium which possesses its unique characteristics contributing to selection of appropriate pedagogy (McCormack & Jones, 1998).

Another critical factor that can contribute to effective on-line learning is the Class Web Site. The Class Web Site provides an organizational structure convenient for students' engagement in the work with course material and for team work (Palloff & Pratt, 1999). Making materials for Web differs from making printed materials because Web has more senses (Porter, 1997).Web project must be readable, informative and it must have clear conceptual and intuitive lanes through parts of information.

Customers want navigation on Web site which won't cause confusion (Hall, 1997). The more interaction there is on Web site the easier students will understand the course contents (Porter, 1997). Many authors agree that interaction represents a significant component in the teaching program. It is a means for learning (Hall, 1997). It is the key element of successful courses and students should use it efficiently in order to achieve the aims of learning and become satisfied with the achieved experience. Interactions in on-line learning are strengthened by specially designed tools for incorporating interaction in virtual classroom, for suggestions concerning access to learning in Web environment, identification and selection of specified activities which are serving well in on-line surroundings. Every tool offers specific opportunities and it has its requirements which make it appropriate only for a certain purpose (McCormack & Jones, 1998).

III. TYPES OF ACADEMIC PROGRAMS

Academic programs for on-line learning, except those on virtual universities, are always realized partially in traditional classrooms (face-to-face). If 80% of the program contents are realized via Web, these programs are considered on-line programs (The Sloan Consortium, 2005). If the contents delivered via Web include 30...79% of the whole program then such programs are called blended / hybrid programs; along with blended / hybrid programs the name blended / hybrid learning is also used.

Blended learning

Development of information and communication technology has brought fast changes in education. The first experiences with these technologies have revealed possibilities for better quality of learning, its efficiency, adaptability and prices. It is obvious now that learning experiences will evolve and become "blended" combinations of traditional methods and learning methods based on technology (Singh & Reed, 2001).

Blended learning represents one of leading trends of current education; it is a combination of electronic learning and traditional learning in a classroom and its aim is achieving maximum learning effectiveness. Blended learning includes the best parts of electronic and traditional learning in order to achieve flexible, price acceptable education and training that can be accessed by wide public both geographically distant and different concerning learning styles and the level of education (Clark, 2003).

The key for blended learning is a selection of the right combination of media which will lead to

optimum solution. Components of online media can be combined with components of offline media (traditional classroom).

Offline components of blended learning can be classified in six groups:

1. Individual learning (at home, at work place);
2. Learning with the help of tutor, instructor or mentor;
3. Classroom learning (lessons, laboratories, seminars);
4. Printed media (textbooks, practicum, journals);
5. Electronic media (audiocassettes, audio-CD, video tapes, CD-ROM, DVD);
6. Radio-TV (TV, radio, interactive TV).

Online components of blended learning can also be classified in six groups:

1. Online contents for learning (simple and interactive resources for learning);
2. Electronic tutor, instructor or mentor;
3. Online collaborative learning (e-mail, mail lists, chatting, virtual classroom, audio-conferences, video-conferences);
4. Online knowledge management (data browsing, making documents);
5. Web (browsing machines, Web- sites, users groups);
6. Mobile learning (laptop, mobile phones).

At designing blended learning we should take care about planned learning achievements, students, their culture, available resources for learning, electronic infrastructure, the extent and possibilities of servicing the proposed solution. [2]

IV. SOFTWARE PLATFORMS FOR DISTANCE LEARNING APPLICATION

Most tools for distance learning (courseware) have a module for preparation, delivery and processing tests online. If such courseware for delivering educational surroundings are used it is normal to use its own tools for online tests, as well. There is no need to buy expensive tools for distance learning if they will not be used completely. If only online tests are needed, then the selection of some sort of open source (free) courseware with a developed module should be considered. The great advantage is that it may be adjusted to needs. The best known platforms will be individually described here.

MOODLE is an acronym of Modular Object Oriented Dynamic Learning Environment. It is a verb which describes the process of an easy pass through a certain material, trying to work only when the student want to (or must), enjoying in the work that leads towards deeper creativity and knowledge.

This verb describes best the origin and development of Moodle system as well as the way the students and teachers may use to access to educational process in distance learning.

Moodle is available as software of the open code (under GNU Public License). In fact, it means that Moodle is protected by copyright but it has some additional freedom. It is allowed to copy, use and change Moodle under the following condition – to enable the others the accession to the open code; original license or information about copyright will not be changed or removed and that the same license will be applied to any solution.

Moodle will operate on any computer which can start PHP and which supports some of better known data bases.

Moodle is a flexible and fast open source tool. It has a support for two bases: MySQL and PostgreSQL. It also has a support for a great number of languages. Great popularity of this tool is based on a simple and fast installing, small requirements concerning computers on which it is performed and on simple integration in the existing systems.

This tool has quickly gained a great popularity among teachers because of its pedagogical features and adjustability to academic environment. Although it has smaller possibilities than commercial tools it satisfies a great number of users who can easily and fast become familiar with these tools.

WebCT is a programming tool used for distance learning or as an addition to classical courses and traditional education. It uses multimedia possibilities that WebCT and Internet technologies enable.

WebCT is one of the best tools for e-learning. It is fairly intuitive for work and possesses a great number of functions. It contains numerous additional tools for help in learning (links, audio, video, dictionary...) and a great number of tools for communication as well.

The program enables a teacher to make certain changes on the course at any time. These changes may or needn't be visible to all students. The access to WebCT courses is authorized. Every attendant or a teacher has his/her user name and password for accessing WebCT.

One of rare tools which except WYSIWYS (What You See Is What You Get) editor possesses an editor for formulae. Support for creation and evaluation of knowledge is excellent as well as statistic review of achieved results. WebCT enables:

- enriching the course by multimedia elements (sound, picture, Internet links, additional information...)
- evaluation of students' knowledge by online tests and tasks
- self-estimation of knowledge
- creating index and a dictionary of important notions that appear in lessons
- communication of students among themselves and with a teacher via forums (discussions) or chat.

The advantage of WebCT-a is in the field of mathematics because it has a qualitative program for easy input and change of mathematical formulae and a quiz that accepts mathematical functions and generates questions on account of them.

aTutor is open source Learning Content Management System (LCMS) designed for needs of adjustment and availability. Administrators can simply install or upgrade aTutor in only few minutes. Instructors can quickly collect teaching content, incorporate it in the package and distribute it online or input already the existing one. Students learn in adaptable environment.

It is simple and intuitive tool which requires minimum time for getting used to work. The main advantages are compatibility with SCORM format, speed, availability and easy installation and maintenance.

There are lots of disadvantages and some of them are:

- The authors of materials cannot put multimedia on the course pages;
- Too general support for multimedia and video conferences;
- There are no private forums;
- Students cannot download their answers and tasks or exchange data with other students;
- There are no students' groups;
- Knowledge tests do not offer enough possibilities.

Despite current disadvantages which will probably be reduced in some future versions, aTutor is a decent open source courseware. Tools for testing and correction are within the list of tools for management. The main task of this courseware is creation of on-line tests and quizzes whose aim is practicing and knowledge check.

At Technical Faculty "Mihajlo Pupin" aTutor has been studied in details and the user interface has been translated in Serbian [3].

AHyCo (Adaptive **H**ypermedia **C**ourseware) is an adaptable hypermedia LMS or a system for e-learning.

AHyCo has basic characteristics of adaptable systems:

- it is based on hypermedia,
- it contains domain models which describes the structure of knowledge within the learning field,
- It contains the user model for storing student's characteristics,
- It is possible to adapt the parts of the system on the grounds of information in the user model.

Adaptability of AHyCo system is implemented by adjustment of hyperlinks and by the help of adaptable series of the learning contents. The system tries to limit students' free movements as little as possible through the learning contents but it directs and leads, in the same time, students towards knowledge acquisition. The first version of AHyCo system has supported only interaction between students and the learning contents by the help of adaptable hypermedia and on-line tests.

IBM Workplace Collaborative Services is professionally business oriented LMS. It is coordinated with all current norms for data exchange and it is delivered with progressive program of intuitive interface for input and arrangement of course contents. The courses can be organized in other programs which are adjusted to the norms as well. The very content cannot be directly arranged by web interface.

Besides the great number of complete work reports and success of individual students it is possible to make conclusions about business progress qualitatively. This LMS could be additionally independently expanded by the use of available and well documented API invitations and, in this way, it can be adjusted to more demanding users.

This is one of rare LMS which have in-built support for blended learning, in other words, a combination of learning in the classroom and e-learning. When deciding about the course organization it is possible to estimate, in advance, when the lessons will be organized in the classroom It is good because, in this way, a complete support for a classroom work is provided(classrooms can be reserved and necessary teaching material – notebook, projector prepared).

Claroline originates from "Classroom on line". Claroline system for learning management is a modern distance learning courseware that can help in improving teaching and the way of teaching.

Claroline is convenient and intuitive courseware which satisfies numerous criteria.

Its great advantage is in the fact that it is Open Source software; it has GNU (General public license) which enables taking original code and its adjustment to own needs. It enables numerous organizations all over the world (universities, schools, associations...) for creating and administrating courses the space for collaboration via the Internet. The courseware is multi-platform one (it is written in PHP language and it uses MySQL base), so it can be installed on Windows, Macintosh Unix, Linux and other platforms; it is used in more than 80 countries all over the world in more than 30 languages.

Progress of technologies caused developing the need for a new way of distance learning by using communication and computer technologies. Claroline was created by a group of teachers (professors, language experts...) who respected pedagogical principles and methods in order to organize and perform the teaching process by using WWW.

The platform is very simple to use and it can be mastered in a short time and used without problems even without previous knowledge from computer field. The authors of Claroline wanted to enable teachers to master technological skills in education and pedagogy and in that way become more creative and independent in implementing pedagogical principles.

BlackBoard represents one of the best courseware for distance learning that has appeared on the market. It is very intuitive for using and can be mastered quickly. It has an excellent support for communication within the course and is one of rare courseware which supports chat and the use of "whiteboard" at the same time.

A great progress of courseware has been noticed especially concerning creation and evaluation, knowledge testing and monitoring the work of students.

Blackboard has web page with 30 days long experimental version in which, both students and teachers can see how it looks like.

dotLRN is e-learning platform of commercial quality, developed on MIT and published under open source license. It contains a support for developing web portal and an option for managing content on web and Internet is originally included.

eLearner is a system for managing e-learning environment. It belongs to generic group under the name LMS. It is adjusted to SCORM standard. Primary orientation is managing a complex e-

learning environment of corporative type and public portals. It does not have courseware for courseware. It enables:

- introducing e-learning participants in the system and organization through group membership,
- implementation of SCORM compatible interactive or passive content,
- organization of attendants, content and tutors according to classes,
- mutual communication,
- on-line teaching and testing,
- monitoring and statistical analysis of the work – individual, group and class,
- writing reports.

Eledge is Learning Management System which provides courseware for creating on-line courses and teaching materials. Eledge secures functional equipment for creating distance learning courseware and instructions for web pages, including students' registration, quizzes, exams, homework, evaluation, uploading data and others.

FirstClass is interesting because it is supported on all standard platforms, such as: Linux, Windows, Macintosh.

It is divided in components Server, Client, Internet Services, Voice Services i FirstClass Directory Services. It provides asynchronous and synchronous communication to users (mail, forums, chat) as well as the exchange of data via folders and common calendars. Its advantage is in that it supports voice mail and fax and it also has wide options for accessing messages in mailbox - if voice mail is in question then it is possible to listen to it via phones or mobiles.

ILIAS is open source courseware which has been developed thanks to reference of Austrian Ministry of Education. Although it is made by using PHP, along with additional libraries its purpose is to be performed only on Linux platform (it was tested on RedHat distribution).

Kewl was made at "University of Western Cape" with the aim to research e-Learning. Later, Kewl was used and developed in teaching, too. Kewl has basic possibilities of majority of commercial tools with the same purpose. A great advantage of this courseware is extensive documentation and the examples of complete courses which can be simply incorporated in it. An option concerning translation in other languages has been anticipated as well.

Manhattan Virtual Classroom is protected by password, web oriented system for e-learning which includes several different discussion groups, synchronous chat, sections in which teachers may

publish materials, module for organization of on-line tasks, module for marks, surveys, private messages among course students...

V. CONCLUSION

The Internet is a powerful means for engaging students' cognitive activities. Individuals and groups of students can cooperate in projects, they can express their interests, taking responsibility for collecting information and within this process they can all communicate with their peers and with experts from all over the world. For a teacher/instructor the Internet opens an electronic door towards resources for learning and practical experiences that couldn't be reached before. No matter in what extent the field of interest is specialized there is always someone on the Internet who can help in finding useful resources. Full potentials of the Internet as a means for learning are still unknown but its capabilities are unlimited.

There is a great number of different courseware and programs for distance learning on the market. Their performances are various, some are commercial and some are free. Very important elements concerning the choice for using are simplicity, smaller requirements related to hardware and software support, larger data bases, openness in loading and regular communication. There are numerous advantages of tests as instruments for knowledge check within web authorized systems: independence related to the place and time of testing, smaller costs for users, possibility for self organizing concerning the time for testing, multimedia materials, an option for test repetition, instantaneous availability of test results.

It is important to know the criteria before selecting the courseware. An attention should be paid to the fact whether it supports the standards for data exchange and the features of the relevant standards.

According to test results, WebCT and BlackBoard have satisfied the highest criteria. However, during testing it seemed that they were not simple and logically connected for using, so they are not recommended even to those who can work on similar systems. They may be recommended only to progressive users.

According to researching factors aspect the following courseware are satisfying: aTutor, BlackBoard, Moodle and WebCT. Taking all said into account, a lot of effort should be invested in this complex field if we want to speak about qualitative evaluation in distant environment.

Two types of courseware are competing closely for the best free of charge courseware - Claroline and Moodle. They are both simple and intuitive for using but Claroline is better according to the number of criteria.

During the analysis it was noticed that a great number of courseware, declared as courseware for e-education, had certain bad sides and they generally lacked a great number of possibilities. Some programs are difficult to install and are rather non-intuitive.

Prior to the courseware selection it is necessary visit web pages of the relevant courseware producer in order to get more details about courseware performances, supported standards, user support, etc. The best advice is to try as many types of courseware as possible and then, according to the objective, make decision about the most appropriate courseware.

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Comparing Wordpress, Joomla and Drupal

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Abstract - This paper will contain the most basic information about the three of the most popular free CMS systems. Also, there would be comparison between them. As the most popular, Wordpress, besides the excellent functions that it possesses, is the simplest for usage. Wordpress is ideal for simple websites, such as everyday blogging and news sites. Wordpress plugins make it easy to expand the functionality of the site. Drupal is used for more complex and more advanced web sites which require complex data organization. Joomla allows site building with more content and structure flexibility than a Wordpress can offer.

I. INTRODUCTION

Content management system (CMS) is web application that includes user interface that allows editing and creation of digital content of web sites. CMS systems allow multiple users to work on content at the same time. Access to CMS systems user interface is through a Web browser.

Most of the CMS systems cover text formatting, version control, indexing, searching, etc. They also include a lot of themes and plugins, which allow new functions to user web site.

The most popular and the most used CMS systems are Wordpress, Joomla and Drupal. [12]

II. ABOUT CMS SYSTEMS

A. Wordpress

Wordpress is open-source content management system (CMS), which means that there are a lot of people working on it for free. Wordpress is currently the fastest growing CMS software. Wordpress is mostly used for blogging, news web sites and web stores, because it is very simple to use. Many of web hosting companies offer automatic installation of Wordpress sites. Wordpress, "5 minutes" installation, makes it very fast CMS platform which allows creating web site very fast. [1]

Figure 1. Wordpress logo

Themes

Wordpress users can install and change a lot of themes. Every Wordpress web site requires at least one theme installed. There is a difference between free and premium Wordpress themes. All free themes can be found in Wordpress Theme directory, while premium theme must be purchased.

Wordpress themes can provide much more control over the look and presentation of the material on website. A Wordpress theme is a collection of files that work together to produce a "skin" and functionality of website.

Themes are created using PHP and HTML programming languages and skinned by CSS style sheets. Wordpress themes are very customizable, which means that users can edit any of files and customize it for their needs. [6]

Plugins

Wordpress plugins allow users to extend the possibilities of the blog or website. There are over 40,000 plugins available online and every theme offers custom functions and features. Plugins are ways to extend and expand the functionality of Wordpress website. With the new Wordpress system version incoming, newer plugins are incoming, too. Old plugins versions don't have full functionality or don't even function on newer versions of WordPress system. [7]

B. Joomla

Joomla is a free, open-source system for publishing content on the Internet. It's available to anyone under the GPL license. Joomla is based on MVC pattern, which can be used independently from CMS. [3] Joomla is written in PHP, and uses object-oriented programming techniques. [9]

Figure 2. Joomla logo
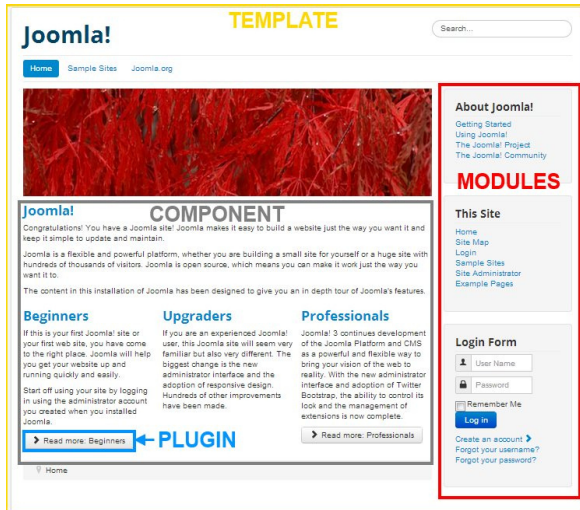
Figure 3. Understanding Joomla design [5]

Extensions

With extensions, user extends functionality of his Joomla website. There are five types of extensions for Joomla [5]:

- Components
- Plugins
- Templates
- Modules
- Languages

Each of these extensions handles a specific function. Many of the extensions are not free and require to be bought before usage. [5]

- Components are the largest and the most complex extensions. Most of the components have two parts: a site part and an administrator part. Every time page loads, one component is called to render the main page body. Components produce the major portion of a page because a component is called by a menu item.

- Plugins are advanced extensions.

- Templates describe the main design of a Joomla web site. While the CMS controls the website content, templates determine the style of a site.

- Modules render pages in Joomla and they don't require HTML to work.

- Languages are very simple extensions that can either be used as a core part or as an extension. Figures and Tables.

C. Drupal

Drupal is also free, open-source system which is based on PHP. Drupal has great standard features, like easy content authoring, reliable performance, and excellent security. Drupal system is very flexible, but for its editing user need to have lot of experience and knowledge. [2]

Figure 4. Drupal logo

Basic installation of Drupal can be used as simple web page, web site with one or multiple users or as internet forum.

Extensions

Drupal design allows extensions, such as modules and themes, which extend the look and functionality of web sites. Drupal isolates basic installation files from modules and themes, in order to enable upgrade without overwriting users' code. [8]

Modules

Drupal possesses over 32000 free modules. Modules offer additional and alternative possibilities such as picture galleries, content listing, private messages and many others.

Some of the most used modules include:

- Content Construction Kit – allows site administrators to dynamically create content type by extending the database.

- Views – facilitate the retrieval of content to site users.

- Panels – "drag and drop" manager, allows the site administrator to visually design their site

- Rules – conditionally executed actions based on recurring events [8]

Theme

Drupal themes use standard formats which can be generated by using independent theme creator. Lot of templates are created by using only the PHP programming language

III. WORDPRESS VS JOOMLA VS DRUPAL

Wordpress, Joomla and Drupal are formed as leaders of CMS systems. These systems are completely free and have great characteristics. They are well secured and very easy for usage.

Wordpress is the most popular CMS system. Wordpress has been downloaded over 150 million times, while Joomla has over 30 million and Drupal just 15 million downloads.

These systems are based on themes and plugins. Joomla has over 1000 free themes, while Drupal has over 2000 and Wordpress has over 5000 free themes. When it is about plugins, Joomla has over 7000 free plugins, while Drupal and Wordpress have over 25000 free plugins.

As they say for themselves, Wordpress is ideal for simple websites such as blogs, news website and store, while Drupal is great for more complex websites that require multiple users and online store. Joomla allows creating websites with more content and also supports e-commerce, social networking and many others.

When it is about installation time, for installing Wordpress website, users need only 5 minutes, while for installing Joomla and Drupal, users need more than 10 minutes.

Perplexity of those systems depends from the user knowledge. Wordpress doesn't require great knowledge and allows his users to create pretty and simple websites for short time. It is very easy to insert text and to copy it from Microsoft Word document, which is not the case with Joomla and Drupal websites. Drupal requires great knowledge, but with newer versions incoming, using Drupal CMS system is becoming easier and easier. Joomla is easier than Drupal but complexed then Wordpress. [10]

A. Multilanguage

Wordpress does a great job, when it is about multilanguage of user interface. Wordpress comes with 53 languages, while new languages can be easily installed by just a few clicks in the Wordpress admin panel. There are a lot of free and premium plugins that allow multilanguage of whole websites. [11]
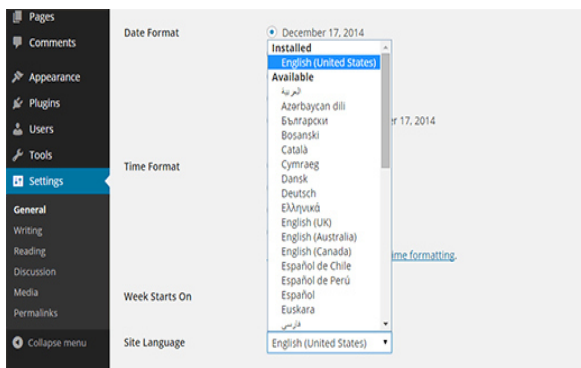
Figure 5. Wordpress language interface

Joomla has ability for handling with multilanguage contents without installing any plugins and extensions. [11]
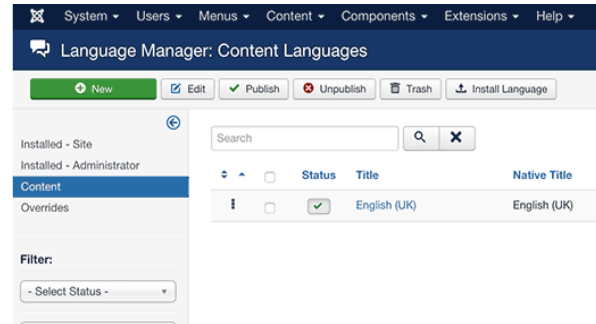
Figure 6. Joomla language interface

Drupal comes with built-in function of multilanguage. After installing module, it is possible to give multilanguage to website or admin panel. [11]
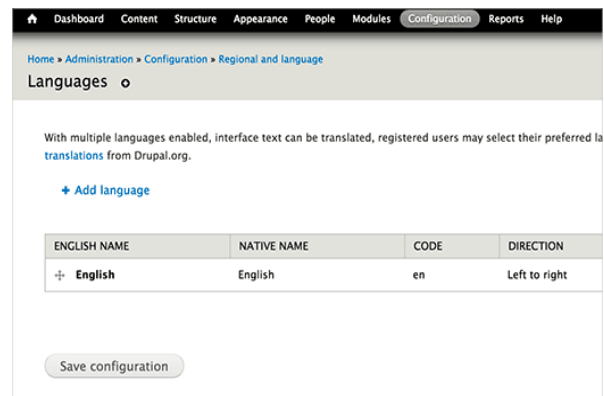
Figure 7. Drupal language interface

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SOCIAL NETWORKS AND THEIR INFLUENCE ON EDUCATION

Analysis of Social Network Random Model and Comparison to Teal Collaboration Network

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Abstract - Social networks are usually modeled as graphs, where entities are represented as nodes and relations are represented as edges between nodes. These graphs can be directed or undirected and weighted or unweighted. Scientists are often using random models to reproduce the properties of real networks in order to analyze their behavior. Random networks or random graphs can be modeled through edge probability, which represents the probability that edge between two random nodes exists. This paper presents analysis of various social network random models. Each model is created as undirected graph, with same number of nodes and different probability. Five properties are analyzed: average node degree, average clustering coefficient, average path length, minimum clustering level and number of nodes in big component. Properties of created models are compared with real social network properties. The paper presents methodology used to generate models and results that were achieved.

I. INTRODUCTION

Social networks are, by broader definition, communities that gather people, or entities on behalf of people, of similar interests or based on common interaction [1]. Social networks are naturally modeled as graphs, which is sometimes referred to as a social graph. The entities are the nodes, and an edge connects two nodes if the nodes are related by the relationship that characterizes the network [2].

Network science aims to build models that reproduce the properties of real networks. Most networks we encounter do not have the comforting regularity of a crystal lattice or the predictable radial architecture of a spider web. Rather, at first inspection they look as if they were spun randomly. Random network theory embraces this apparent randomness by constructing and characterizing networks that are truly random [2].

In this paper authors will present analysis of various social network random models and comparison of results to real social network properties.

In chapter Social network random model authors give detail description of random models and characteristic properties of social networks. Chapter Methodology contains description of used tools, technologies and algorithms. Achieved results are presented in chapter Results and Discussion. In chapter Conclusion authors give their view of the analysis and propose future work on this topic.

II. SOCIAL NETWORK RANDOM MODEL

From modeling aspect, social networks are simple to create – they consist of entities and relations between entities only. Thus, they can be easily modeled as graphs, where entities would be represented as nodes and relations by edges between nodes [3]. However, the challenge is to construct a model that represents the real system, i.e. the real social network, in the best way. In that sense, philosophy of random networks is simple: the assumption is that the best representation of the real system is generated by randomly connecting any pair of nodes. The definition of random networks is derived from that assumption: A random network consists of N nodes where each node pair is connected with probability p [4].

To construct a random network, these steps are followed:

- Start with N isolated nodes;

- Select a node pair and generate a random number between 0 and 1. If the number exceeds p, connect the selected node pair with an edge, otherwise leave them disconnected;

- Repeat second step for each of the $N(N-1)/2$ node pairs.

The network obtained after this procedure is called a random graph or a random network. Two mathematicians, Pál Erdős and Alfréd Rényi, have played an important role in understanding the properties of these networks. In their honor a random network is called the Erdős-Rényi network [5].

Social networks can be roughly divided into two types: directed and undirected. In directed networks existing edge from one node to another does not necessarily imply reciprocity, e.g. email networks: one email sent from an address – node to another creates a directed edge, etc. In undirected networks existing edge marks bidirectional connection between nodes, e.g. in collaboration network where entities are authors of scientific papers, edges represent collaboration between those authors and point to existence of at least one joint paper.

In this paper authors will analyze undirected random models of social networks for constant number of nodes N and different values of p. However, each time a random network is generated, in spite of using same values for N and p, the network will look quite differently and will have at least slightly different properties (as shown on fig. 1). Considering that fact, in order to get more precise results and makes them relevant for analysis, authors generated random networks with constant N, and 15 separate networks were generated for each value of p. In the paper authors will present the average values of tested parameters for each value of p.
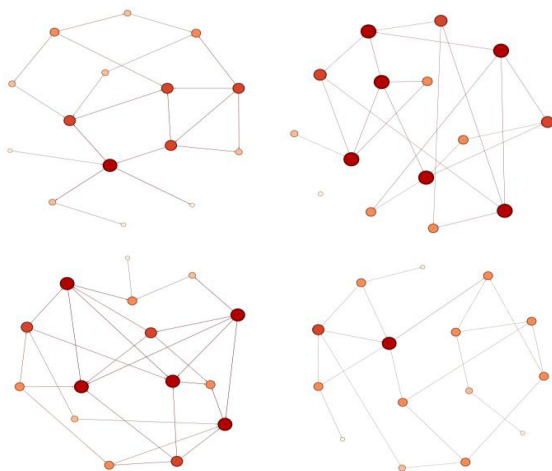
Figure 1.   Randomly generated graphs with $N = 15$ and $p = 0.2$

Real social networks can be described using four properties [2]:

- Node degree distribution, that shows number of edges between particular nodes;

- Growth of the big component, which is significant from aspect of determining whether the network is in subcritical, critical, supercritical or connected regime;

- Clusterization coefficient, which shows relations between neighbors of a node (how much are they connected);

- Average length of shortest path between two nodes.

A. Node degree distribution

On random networks shown on fig. 1, it can be seen that some nodes have a lot of edges, while some have only a few or don't have any connected edge. These differences in node degree are caused by probability p that affects the occurrence of an edge between two nodes in a random network. Probability that a node has exactly k edges, i.e. that it has a degree of $\langle k \rangle$, for a random network with parameters (N, p) can be obtained by binomial distribution equation [6]:

$$p_k = \binom{N-1}{k} p^k (1-p)^{N-1-k} \qquad (1)$$

Most of the real networks are sparse, which implies $\langle k \rangle \ll N$ [6]. With this condition, node degree distribution from equation (1) can be well approximated by Poisson's distribution:

$$p_k = e^{-(k)} \frac{(k)^k}{k!} \qquad (2)$$

Poisson's and binomial distribution describe the same distribution type and have the same properties, but are represented in different parameters. Finally, in random social model, it is expected that every individual has approximately the same number of acquaintances, which presumes exclusion of exceptions: there are no individuals that are extremely popular, having much more than average number of acquaintances, nor those that are left out of society. This leads to conclusion that in random model the degree of each node is in close proximity of $\langle k \rangle$, which does not coincide with reality [7]. In random networks most of the nodes have similar degree and the existence of hubs, i.e. nodes with large number of edges, is excluded. On the contrary, in real networks there can be seen large discrepancy from average node degree in actual nodes, and definite existence of hubs [8].

B. Growth of the big component

Interesting characteristic of real social networks is existence of the big component. In real social networks a cluster that stands out from other clusters in its size can be observed. For a big component to exist as such, each node that it contains must be connected to at least another one that is member of the big component [9].

For small random networks p has to be large for a big component to exist, while in larger networks smaller p is required in order to cross the threshold of the big component existence, i.e. for network to reach its critical point (equation (3)).

$$p_c = \frac{1}{N-1} \approx \frac{1}{N} \qquad (3)$$

C. Clusterization coefficient

Knowing the node degree does not reveal any information on connections between its neighbors, whether they are directly connected or not. Answer to this question is given by local clusterization coefficient C_i, which measures the density of edges between direct neighbors of node, i (nodes that i is connected to via single edge, also noted as nodes on distance 1 from i) [10]. If $C_i = 0$, then direct neighbors of node i do not share any edge. However, if $C_i = 1$, then every direct neighbor of node i is connected to all other direct neighbors. Local clusterization coefficient in random networks is given as [2]:

$$C_i = p = \frac{(k)}{N} \qquad (4)$$

In order to test the value of equation (4), in his paper "Network Science" Barabási showed comparative analysis of expected and real value of C_i in real social networks [2]. During the research he concluded that clusterization coefficient does not shrink proportionally to $1/N$, but still is largely dependent of N. Finally, he concluded that clusterization coefficient of random networks does not coincide with clustering coefficient of real networks, but real networks have much larger clusterization coefficient than expected.

D. Average shortest path length

Small world phenomenon, also known as "six degrees of separation", has significant role in network science. The phenomenon states that if one observes any two people in the world, there exists a path between them that consists of no more than six different persons, where one is acquainted to the next. In network science sense the phenomenon indicates that the path between any two nodes is short [11]. Two questions arise from that statement: what does it mean "short" path (short in comparison to what?) and how to explain the existence of those short paths.

Both questions can be answered by observing quite simple calculation. A random network with average node degree $\langle k \rangle$ is observed. An arbitrary node in such network has: $\langle k \rangle$ neighbors on distance 1 ($d = 1$), $\langle k \rangle^2$ neighbors on $d = 2$, ... $\langle k \rangle^d$ neighbors on distance d. More precisely, expected number of nodes on all distances up to and including d, from an arbitrary node is:

$$N(d) = \sum_{i=0}^{d} (k)^i = \frac{(k)^{d+1}-1}{(k)-1} \qquad (5)$$

from which, under assumption that $\langle k \rangle \gg 1$, it can be derived that [2]:

$$(d) = \frac{\ln N}{\ln(k)} \qquad (6)$$

When equation (6) is applied on real social network, it produces $\langle d \rangle = 3.28$. Therefore, it is considered that all people in the world are separated by three to four "handshakes", i.e. any person can be reached by three to four steps following relations "friend of a friend", starting with one's own friends.

III. METHODOLOGY

This paper's goal is to determine the behavior of social network random model, depending on the different values of probability p of existence of edge between two nodes. Dataset used for this research is created by Java application for creating undirected random graphs. The following parameters are input into the application: number of nodes N and probability p. Afterwards, the application generates a random graph with given parameters. Also, randomly generated networks will be compared to the real social network: collaboration network of University of Montenegro (UoM).

The data source for this network is portal www.nastava.ucg.ac.me, where one can find publications of researchers at the UoM since 1975. The database of the UoM research and scientific papers contains 237 authors, which are presented as 237 nodes of the graph (N). Mutual cooperation on at least one paper has made a total of 425 pairs of authors, which is represented as 425 edges between nodes of the graph [12]. This produces probability of edge existence, in terms of random networks, of $p \approx 0.0152$ (further in text as p_r).

Values chosen for p in this research are: threshold for creation of big component characteristic for social networks ($p_c \approx 0.004$, from equation (3)), real probability from collaboration network (p_r), as well as one value below p_c and above p_r and two values in between. Thus, value set, rounded to three decimal places, is {0.002, 0.004, 0.007, 0.010, 0.015, 0.020}. Note that $p_c < p_r$. Number of nodes in all random networks is the same as in reference collaboration network, in order to obtain directly comparable results.

In order to visualize and analyze the graphs authors used Gephi [13]. Gephi is leading free, open source visualization and exploration software for all kinds of graphs and networks. It is written in Java

on the NetBeans platform, and it is used in a number of research projects in academia, journalism, network analytics and elsewhere.

Four main properties, described in chapter II, were analyzed (node degree, clusterization coefficient, big component and shortest path length), as well as:

- Diameter, which is the longest graph distance between any two nodes in the network;

- Girvan-Newman algorithm minimal clustering level, i.e. number of components in graph;

- Number of nodes in big component, if it exists.

An important aspect of social networks is that they contain communities of entities that are connected by strong or numerous edges [9]. Many algorithms for community detection in networks are mainly identical to clustering algorithms in graphs. For clusterization of random graphs authors used Girvan − Newman algorithm (GN) [14]. GN is well known, efficient one of the most widely applied algorithms for social network graph clustering.

GN is based on detection of edges that are least likely to fall within the same cluster. To that purpose, the graph edge is given a new parameter − "betweenness". GN detects clusters by progressively removing edges from the original network. The connected components [15] of the remaining graph represent the resulting clusters. Connected component of a graph is a subgraph in which any two nodes are connected to each other by paths, and which is connected to no additional nodes in the super graph.

Instead of trying to construct a measure that tells us which edges are the most central to cluster, GN focuses on edges that are most likely "between" clusters. In that purpose, GN is divided into two main phases − in the first phase it calculates betweenness for every edge in graph and in second phase it uses that betweenness to cluster the graph.

Betweenness of an edge (a, b) is the number of pairs of nodes x and y, such that the edge (a, b) lies on the shortest path between x and y. To be more precise, since there can be several shortest paths between any x and y, edge (a, b) is credited with the fraction of those shortest paths that include the edge (a, b). The bigger the number, it suggests that the edge (a, b) runs between two different clusters; that is, a and b do not belong to the same cluster [14]

Finally, GN clusters the graph using the calculated betweenness. It starts by removing the edges from the graph in order of decreasing betweenness: it begins with the graph and all its edges, and then removes edges with the highest betweenness, as many times as it is needed, until the graph has broken into a suitable number of connected components.

In this analysis GN is used for finding properties of big component.

IV.   RESULTS AND DISCUSSION

Table 1 shows results that were obtained from generated networks and real collaboration network. In order, networks analyzed are: UoM real collaboration network ($p \approx 0.015 = p_r$), and random networks with: $p < 1/N$ (subcritical regime), $p \approx 1/N$ (critical point) [2], $1/N < p < p_r$ (2 networks), $p = p_r$ and $p > p_r$. Properties of random networks are presented as average values of properties of 15 networks created for each given p. All numbers are rounded to three decimal places.

Because of difference in nature of random algorithms and real networks construction, there is significant difference in clustering coefficient and average degree in two types of networks. In real networks existence of the edge between two nodes is somewhat dependent on indirect connection of those two nodes (whether their direct neighbors are directly connected between each other), while in random networks there is a lack of that parameter, i.e. real networks cannot be considered or exactly modeled as random. By results obtained, in order to achieve similar results in clustering coefficient as in real network, p would have to be increased to several times higher value than p_r.

TABLE I.   REAL AND RANDOM NETWORKS PROPERTIES

Network Property	Real network (UoM) p_r = 0.0152	Random networks with varying *p* (averages)					
		p = 0.002 *(p < 1/N)*	*p = 0.004* *(p ≈ 1/N)*	*p = 0.007* *(1/N < p < p_r)*	*p = 0.010* *(1/N < p < p_r)*	*p = 0.015* *(p ≈ p_r)*	*p = 0.020* *(p > p_r)*
Node degree	3.586	0.274	0.467	0.786	1.149	1.785	2.257
Clustering coefficient	0.707	0.000	0.001	0.006	0.021	0.024	0.031
Average path length (P)	3.330	1.737	5.031	8.357	5.923	4.387	3.763
Diameter in P	8.000	5.000	15.400	19.800	15.000	9.467	8.000
Minimal clustering level	28.000	174.733	129.000	66.533	30.467	6.467	4.000
Does big component (B) exist?	Yes	No	Yes[a]	Yes	Yes	Yes	Yes
Number of nodes in B	155	N/A	22.400	121.000	198.533	230.800	231.267

[a] - big component formed in 66,7% of generated networks.

Number of generated clusters and big component size also differ because of the same reason, but they show different dependency: results similar to real network are obtained in $p < p_r$. When further increasing *p*, we obtain larger big component, until it engulfs almost whole graph at $p \approx \ln(N)/N$, in this case 0.023, roughly coinciding with largest *p* tested [2].

Average path length and diameter in random networks are comparable to real network at $p \approx p_r$, but they are more similar to real network at larger values of *p*, approximating $\ln(N)/N$.

V.   CONCLUSION

In this paper authors give analysis of random network model, using different probabilities of edge existence between two random nodes, and comparison of those networks to real collaboration network at UoM. Also, the authors present methodology and algorithms used to obtain analysis data.

Based on obtained results, it can be concluded that none of the generated random networks have all the properties similar to real network. That happens because of difference in nature in two network types: real networks are not entirely random.

This difference arises a challenge in future work to improve random network generation algorithms with codependency factor which would change p of connecting two nodes based on their relations to their neighborhood.

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Childern and the Internet

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Abstract - Internet plays an important role in everyday life, because it affects the formation of habits, beliefs and attitudes of children. It facilitates their education, but also fun and entertainment. Internet is the biggest discovery in the field of means of communication. However, the parents of this way of communication are often a concern. Although they try to see the good side of "digitized" child imposed a number of disadvantages of the Internet. As always, the solution is somewhere in the middle, and it is not black to white.

I. INTRODUCTION

Internet is the most powerful educational and communication medium in history. It is the most interesting toy for children, which exists in the world. They use the Internet to do research, to communicate, to play games and for entertainment [1]. The number of children who use the Internet at school or at home is growing from year to year. The growth rate is such that in a few years, each family will be connected to the Internet.

Some families are reluctant. People have read about the dangers that lurk on the Internet, watching television news and special programs that highlight and one darker side of the Internet. For these parents, there is only one and it is very simple possibility: to keep their children away from the Internet. Restrict your child; you have a computer that uses the Internet can be more harm than good. Kids just have to be computer literate to succeed in school, completed college and finally got a job at a workplace.

Internet is no longer a matter of choice. It is crucial for the future of children. It is important to provide every child access to that technology. On the other hand, we need to teach children that safely and securely use the Internet. We have to understand what risks are involved and how they can reduce their impact. Of course, the computer and internet have not been the dark side of the world, but aimless and uncontrolled use of the Internet is a great danger for children but also for adults. When children are concerned, the danger is, of course, much higher.

II. USE OF THE INTERNET

The Internet is a global computer network that connects millions of users around the world. It provides a number of options, ranging from information from the life, culture, entertainment to education and training. People do not go to the doctor because the symptoms of the disease and possible treatment options on the Internet, looking for recipes for cakes on the internet, as well as solutions of many of their problems, meet new people, chat, chatting, ... Through the Internet, they can visit the galleries, museums; you can see and experience the atmosphere of a particular city, country or continent. Internet provides a new payment method, without the crowds and inconvenience. Some argue that the best things bought on the Internet, and some that best earners via the Internet.

Figure 1. Use the Internet

The Internet offers a wealth of information and opportunities, so the question is what kids are looking at him (Fig. 1). Year after year an increasing number of children access the Internet, especially in younger children. The age limit at which children begin to use computers all lower, it often happens that children are computer literate than their parents [2]. If the parents do not talk enough with their children, they will be on the Internet rather than useful and entertaining to find dangerous and banned content.

Initially, the child is difficult to separate the computer and the Internet as two separate phenomena. However, after the experience of these two phenomena is conditioned by their individual use. When a child is a real desire for the computer based solely on his curiosity and imagination. But if the child does not exist, it should not be imposed. The weather will make own, but will these things occur in older age. Just buying a computer for a child is the provision of expensive toys with countless violent games, while access to the Internet to communicate with virtual worlds. If the child show all possibilities offered by the computer and the internet, we will give him creative tools for hobby and learning. Consequently, any child acquires habits, internet station, or beneficial or dangerous media.

At a younger age the internet is completely useless for the child, because it is unable to understand its true meaning and function. For many children this medium is even boring. When a child finds some sense of the Internet, it will not be usefully employed, but will use it to meaningless "crushing" by the sites. Then it attracted only attractive games which are in most cases, coarse and violent, but on the other hand are only a waste of time. To the child found the true meaning of the Internet, it can take some time. Then it should be directed to the content, which might be interesting for hobby and school. It should be noted that the child in this period safe on the Internet. It is not aware of the many possibilities of the Internet, nor will explore in different directions, some of which can be extremely dangerous.

At an older age the child understands that need to use the Internet to [3]:

- learning (the child has access to information, opinions ...)

- communications (express ideas, exchange information and experience)

- social interaction with friends and peers

- creating and sharing content

- Game and entertainment (movies, music, books ...).

All these activities can take place at home, school, café, bus park; on the street ... A child can access the internet from traditional desktop computers, laptop computers, tablet computers, mobile phones...

Today, children are increasingly visiting inappropriate sites; participate in on-line gambling, watching violent movies and pornography. There is a child who does not have a profile on one of the social network who visits daily. Of course there are children who attend courses on the Internet, learn foreign languages, and are formed. This is very useful because it saves time and is available to everyone. First of all, the Internet offers plenty of opportunities for entertainment and education, the only problem is how to remain a child to learn to use the Internet properly. Parents should not be lazy in the story with the children. Prohibited topics may not exist. And the child and his environment is always better to obtain reliable information on the Internet, as we know you always get the answer on the Internet, as it remains the only answer.

Compared to other technologies with which we encounter daily, such as, for example, radio and TV viewing, internet represents a unique opportunity for parents because they can directly affect what their children see and do online. For example, can guide the child in a useful and entertaining content that is tailored to their age, culture, intellectual abilities, education ... On the other hand, the internet provides opportunities to educate children about constructive use and provides guidance on how to avoid risky behavior online and inappropriate content. It is essential for all, where parents, teachers and institutions should work together to create a safe and accessible environment for children and young people wherever you are (at home, at school, in public institutions, cafes ...). It is the responsibility for all to create an environment in which all children and young people will be able to enjoy and benefit from the positive aspects of the Internet.

III.   ABUSE OF THE INTERNET

With the increased role of home computers in children's lives has come increased concern about how children may be affected [4]. Children and young people are faced with a wide range of risks when using the internet. Some of these risks are actually a threat to their security, privacy ... In particular, these risks can be as follows [5]:

- exposure to inappropriate images or content, either intentionally or unintentionally

- on-line abuse or harassment

- disclosure of personal data and their thefts

- various scams ...

Children are the most numerous group of internet users if they are unable to assess the potential risks, are threatened. Mutual cooperation at local, national and international level is the most effective way to create awareness about the important issues of protecting children in some regions of the world.
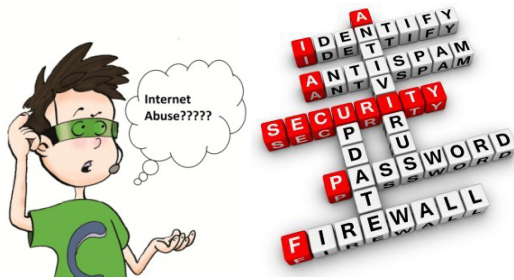
Figure 2.   Abuse the Internet

Use of the Internet with the intention of forcing and blackmail is a form of violence or abuse (Fig.2). A milder form presents music and film, a severe form of pornography, pedophilia and communication with the aim of exploitation, harassment and abuse. In this type of abuse can be counted, and facilities with inadequate information and distributing legally inappropriate material. In this case focused on sites with harmful themes - such as suicide, anorexia, kidnapping, abortion, Nazism, drugs, of which there are tens of thousands in the world.

Sites with the recommendations of the various types of diet and exercise, but also with other "useful" tips for health, they are very dangerous, because their texts appeal to young people. They lead to consequences ranging from physical injury to illness and even death. The main problem is that parents today have no clear idea about the internet and its possible abuse, but have no awareness of the fact that a number of children found on the Internet material prohibited content.

Malicious persons use the Internet to access children usually through misrepresentation. After such a person to gain the child's trust, followed by sending photos, references to web portals or scheduling meetings and exchanges of personal contacts. In this last stage of a child forced by blackmail or certain force to the desired activity. This does not apply only to sex, but also to other types of exploitation - theft, fraud and the like.

Privacy is now something that is much more difficult to preserve. Kids especially need to draw attention to the dangers that threaten them if they set accurate information about themselves, address, telephone number, e-mail password, date of birth and so on. It is dangerous to post pictures, constantly and frequently, because the Internet is a network that is not controlled. You never know who's sitting on the other side of the computer. Today, more and more frequent identity theft, kidnapping, and all because of information that are placed on the social network.

In the sphere of the Internet play a significant role, and mobile phones. They allow individual abuses through access to the Internet. Increasingly, we are witnessing the images on the Internet, which are made by mobile phone. The objectives of these recordings were mockery or even bullying. In this way children become bullies at school and blackmailers.

Although we do not work the way, the truth is that all this happens more often than we are aware. If we ignore for a moment the extreme cases, the fact remains that children connect to the internet and play games or spend time on social networks and similar sites. Since almost every child has their own computer or mobile phone, and only a small number of under controlled conditions, it opens up a wide field of possibilities not only for the misuse of the Internet, but also for futile waste of time. Precious time is increasingly used for leisure and entertainment, not education and training.

IV.   CHILD PROTECTION ON THE INTERNET

Understanding the impact of computer use requires good estimates of both the time children spend on computers, and the time taken away from other activities [6]. Parents should ensure the safety and security of children to Internet. The task of parents is to inform the child what is for him a good and useful and what is dangerous and useless. The attitude of "better be in your room, at least I know where he is ..." does not provide any security.

If the child is communicating with evil and bad
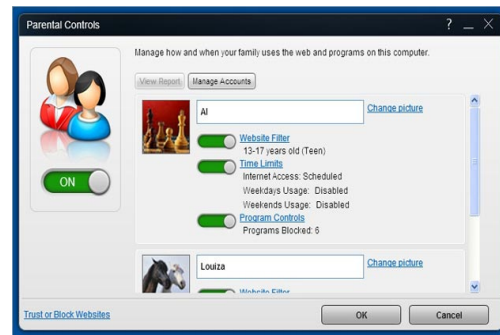
Figure 3.   Software for Children on the Internet

people and absorbing their pernicious ideas through the Internet, anything can happen. The passivity of parents plays a key role in the high degree of risk, which threatens their child. When your child buys a computer, parents with him move into a new world that does not need a lot of knowledge, but need a lot of caution, commitment and continuous study of the child's interests.

Possible directions for the protection of children on the Internet are [7]:

- familiarizing parents with the child's interests

- placing the child on the possibility of utilization of computers,

- simply imposing directions for its use

- software limit computer without the child's knowledge

- review the history of Internet and computer programs

- interview on the sites, which are visited by children and commenting on their good and bad characteristics.

Generally acceptable solution is parental involvement in children's activities and makes their tireless children that alone learn to distinguish between right and wrong. Today there are many ways those malicious persons approaching children. It would be best that the children themselves have the ability to recognize a bad person and those they resolutely refuse its own.

The best protection is to monitor what the child is doing on the Internet [8]. Today, there are distinct programs for child protection such as:

- programs that record what is done on the computer addresses that are frequented all the records in this particular text files that your child is ticking so you'll always be up to date what your child is doing,

- programs, which may prohibit, limit or monitor certain websites, the use of chat clients and other online tools,

- programs that recognize the content of web pages that could be harmful to children and allow parents to prevent children from visiting these inappropriate websites,

- programs that are specialized web browsers for kids and designed to be safe for children and that they still allow to some extent surf the Internet.

Regardless of the presence of a large number of different programs, protection of children on the internet can be complicated, but Windows Live Family Safety to facilitate. It is installed on the computer of children, so that you can give them some freedom, and still have access to their computer activities. Ways that helps protect children include [9]:

- web filtering - control category web sites that your children can view or specify the individual locations where they can or cannot access,

- activity reports - receive reports on the child's computer use: Web sites that children are visited or tried to visit, time spent on computers, as well as games and applications that are used.

- time limits - limit the amount of time that children spend in the use of computers and specify the time during the day it can be used.

- restrictions on games - limit which games children can play,

- limits for the programs - programs that restrict children can start.

V. CONCLUSION

The Internet is the means which allows us to communication, education and entertainment. And it's all at the same time. As with everything, and the Internet provides a lot of good and bad sides. There is the problem of how children learn to properly use the Internet. The fact is that many parents feel that their children are safer at home than the street next to the computer. However, it has become very worrying. Violence on the Internet is growing, and in an environment of virtual communication at first glance it seems that the law, technology, schools and parents can do very little to stop them.

Of course, the computer and internet have not been the dark side of the world, but aimless and uncontrolled use of the Internet is a great danger for

Figure 4. Windows Live Family Safety

children but also for adults. When children are concerned, the danger is, of course, much higher. But children cannot restrict, prohibit them to use the internet. In fact the contrary, they can limit the time that will be carried out on it, keep track of sites that they visit and finally lead them to the right path of Internet use. We cannot restrain children to use the internet, something that is contemporary, but we have to try to get into step with the age in which we live.

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The Impact of Social Media on Students' Education

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Abstract - Information technology brought a wide range of changes in social interactions of people. The digital age implemented a wide variety of information tools which are used in everyday tasks. Communication and information distribution is fundamentally changed. Social media sites are prospering, and hundred millions of people are present on these social media sites. Multimedia content is available to everyone who has a computer and access to the internet. Students use social media sites on a daily basis. From learning, exploring, to gaming, teens and young adults are engaged in all of them. There surely is an impact of social media on high school students, and in this paper, the major factors will be defined.

I. INTRODUCTION

Information technology is an integrated whole of intellectual tools. These tools offer a wide variety of options for use in various science fields and industries. The digital age gave people new ways of communication and interaction. Rise of the information society brought computers to workplaces and they changed the education system. It is possible, to distinguish five definitions of information society [1]:

- technological (the use of information for the advancement of technology)

- economic (information based economic theories change the view of macro and micro economics)

- occupational (information in use of occupations)

- spatial (information flows freely in predefined distribution channels)

- cultural (new cultural trends arise from free information distribution)

Information technologies found their way into the education system in two ways. The first one through educational programs, new IT course implementations and other organized ways of IT use in the teacher-student relations. The second one is the impact of social media. Social media has an impact on students. The social communities, which are present on social media platforms, often don't provide intellectual, profound value. Students roam freely, and are influenced by various distractions, unmoral content, thus creating a new generation of non-emphatic, focus-lacking people, who will further spread this abomination of non-cultural behavior. These assumptions lie on the further arguments in this paper.

II. THE USE OF SOCIAL MEDIA

Engaging in social media interactions is a routine activity that research has shown to benefit children and adolescents by enhancing communication, social connection, and technical skills. Social media sites offer multiple daily opportunities for connecting with friends, classmates, and people with shared interests. During the last 5 years, the number of preadolescents and adolescents using such sites has increased dramatically. According to a recent poll, 22% of teenagers log on to their favorite social media site more than 10 times a day, and more than half of adolescents log on to a social media site more than once a day. Seventy-five percent of teenagers now own cell phones, and 25% use them for social media, 54% use them for texting, and 24% use them for instant messaging. Large part of this generation's social and emotional development is occurring while on the Internet and on cell phones [2].

These facts clearly show there is an aggressive social media content consumption. Teenagers are using their mobile gadgets to access this content. Social media sites provide an enormous amount of multimedia data. From pictures to videos, there is no end to what can be found on a profile of millions of users on the grid. The online social network application Facebook enables its users to present themselves in an online profile, make new friends who can post comments on each other's pages, and view each other's profiles. There are millions of groups where users can share interests, see what classes they have in common, and learn each others' hobbies, musical tastes, and romantic relationship status through the profiles [3]. A research conducted at the University of Texas, showed that there are

factors which determine the intensity of social media use. These factors include gender, age, education life satisfaction, emotional stability and openness [4]. All of these personality traits and characteristics are present in some percent, and where some are more open and less emotionally stable, others can be less open to new friendships and have a higher education. Correlations between personality traits and use of social media exist, but there are exceptions as well. High school students have a very dynamic personality [5]. Mood swings are common, and fluctuation in behavior is present.

Majority of social media sites such as Facebook, Instagram, Pinterest, Tumblr and other, have a significant impact on the education of high school students and students overall [6]. The goal here is to define the most influenced aspects of high school students and the resulting consequences or benefits that may occur.

III. BENEFITS OF USING SOCIAL MEDIA SITES BY HIGH SCHOOL STUDENTS

Social media sites allow students to accomplish many tasks revolving around their homework. Sharing insights about different topics regarding their studies, students get a chance to share knowledge. There benefits as [1]:

- opportunities for various community engagements through raising money for charity and volunteering for local events;

- improvement of individual and collective creativity through development and sharing of artistic and musical endeavors;

- growth of ideas and increased brainstorming from the creation of blogs, videos, and gaming sites;

- expansion of online connections through shared interests;

- fostering individual identity and unique social skills.

High school students are using social media to connect with one another on homework and group projects. Social media programs allow students to gather outside of class to collaborate and exchange ideas about assignments. Creative writing can be nurtured through collective writing platforms and other tools. Teachers can evaluate and help students in their essay writings and other homework or extra curriculum activities. Research show, that almost half of all faculty and high school teachers are using regularly social media sites (see Figure 1) [7].
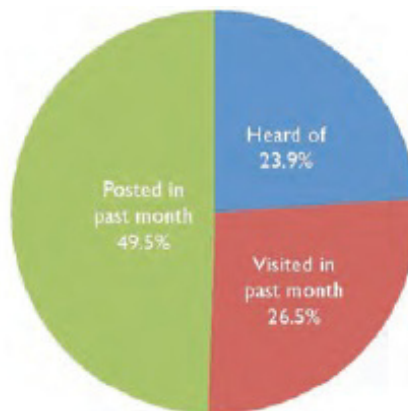
Figure 1. Personal use of social media by faculty and high school teachers and professors

Further on, faculty members are more prone to social media sites than other workplaces. (see Figure 2) [7].
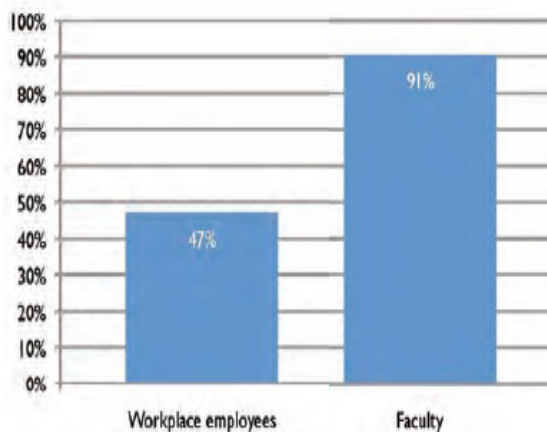
Figure 2. Comparison of professional social media use by workplace employees and faculty

The difference is clear. Social media use by faculty employees is 40% higher than other workplaces. This is due to major benefits of information technology and the use of social media site based communication. This means that students can have good connections with the faculty or high school, and have better interactions with their teachers and professors. Schools successfully use blogs as teaching tools, which has the benefit of reinforcing skills in English, written expression, and creativity. Social media often inspires new creativity in the way that subjects are taught [10]. Other benefits of social media for students are health care.

Accessing health information is increasingly available to youth on a variety of topics of interest to this population, such as sexually transmitted infections, stress reduction, and signs of depression. Students with chronic illnesses can access sites

through which they can develop supportive networks of people with similar conditions. Cell phones, instant messaging, and text messaging, have already produced multiple improvements in students' health care, such as better disease understanding, and fewer missed appointments. Teenagers have enhanced opportunities to learn about their health issues and communicate with their doctors. However, parental involvement is required so the students can be sure they are using reliable online resources, interpreting the information correctly, and not becoming overwhelmed by the information they are reading [1].

Online courses and online teaching is a new way of spreading knowledge. There are many social media sites and other plain interactive sites which provide useful content. Figure 3. shows how much of this useful content is used in classrooms.
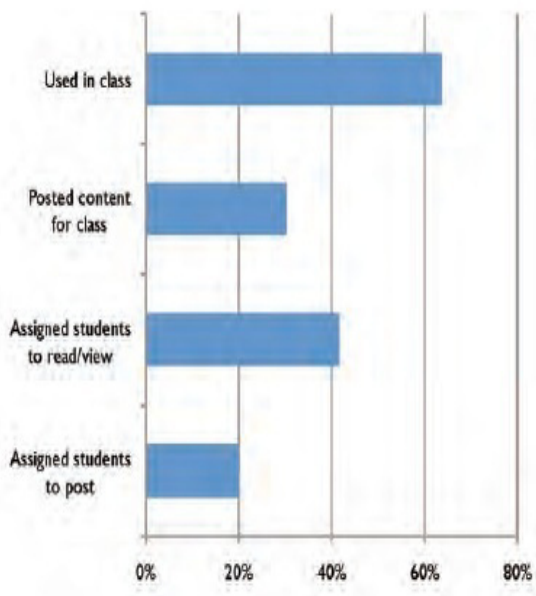
Figure 3. Faculty use of social media in class and for student assignments

As seen above, over 60 percent of social media use is in faculties, are in class. This level of integration of social media into to the education system is very aggressive; therefore a certain level of control needs to be established. To conclude the above:

Proposition 1: Social media use in education has several benefits to students and professors, but content control is necessary for a safe communication environment.

There are times when students find that having overly extensive and rich access to a professor's personal life through social media sites diminishes their credibility [8]. In the next section further

negative influence of social media sites will be defined.

IV.   RISK OF SOCIAL MEDIA USE BY STUDENTS

Using social media becomes a risk to students and teens more often than most adults realize. Some of the risks fall into the following categories [1]:

- inappropriate content;

- lack of understanding of online privacy issues;

- outside influences of third-party advertising groups.

Cyberbullying is deliberately using digital media to communicate and spread false, embarrassing, or hostile information about another person. It is one of the most common online risks for all teens. Similar but not the same, there is online harassment which is rarer. Cyberbullying can cause profound psychosocial outcomes including depression, anxiety, severe isolation, and, tragically, suicide [1]. As mentioned before, teens are prone to dynamic mood swings, and combined with online harsh communication from others can cause severe consequences. In short the above arguments suggest:

Proposition 2: Emotional imbalanced teens are in higher risk of cyberbully attacks and are more prone to self-loathing, isolation from others, depression and self-harm.

Other main risk to preadolescents and adolescents online today are risks from each other, risks of improper use of technology, lack of privacy, sharing too much information, or posting false information about themselves or others. These types of behavior put their privacy at risk. One of the biggest threats to teens on social media sites is to their digital footprint and future reputations [1].

Students may post harmful content, which doesn't seem to be a "big deal", but later may bring problems (e.g. rejection from a high educational facility due to "dirty" background, failing to find a job that requires a "clean slate" like politicians, judges). Thus, students have to be very careful what they share with others, what content is the uploading and presenting. All actions on social media create a picture of the person who shared, uploaded and communicated harmful content. Privacy is not safe, and there are many cases where private information leakage caused negative outcomes on personal lives.

Many social media sites display multiple advertisements such as [9]:

- banner ads;

- behavior ads (ads that target people on the basis of their browsing behavior);

- demographic-based ads (ads that target people on the basis of a specific factor such as age, gender, education, marital status).

These ads influence not only the buying tendencies of preadolescents and adolescents but also their views of what is normal. It is particularly important for parents to be aware of the behavioral ads, because they are common on social media sites and operate by gathering information on the person using a site and then targeting that person's profile to influence purchasing decisions. Many organizations are now prohibiting ads on sites where children and adolescents are participating. Other factors such as race still play a role when it comes to social media friendships. Clear socio-economic differences exist in individuals' predilection to produce (rather than consume) online content, such as blogs, sharing resources or creating profiles College studies report that social media environments are no more socially integrated than offline contexts. Race has been found to remain the overriding predictor of whether college students are Facebook "friends" or not. Social media do not necessarily overcome issues of offline disabilities but instead often exacerbate the boundaries of disability [11].

V. CONCLUSION

Information technology opened new horizons for a broad spectrum of users. From children to elderly, almost everyone benefits from the digital age. Information society achieved amazing communication infrastructure where information and multimedia content flows freely. Information technology opened door for new educational, health and organizational systems. Social media sites grew like grass after rain, and hundred millions of users are "plugged in" to the grid. Students benefit greatly from social media in the education system.

Collective information sharing, creative groups, integration of helpful learning tools are just a few which improve the learning and studying process. However, there are risks, problems regarding social media sites and their use and implementation in schools and faculties. Harmful content can jeopardize students' future professional careers. Privacy is not fully enclosed, and private information may end up in the wrong hands. Social media clearly has an impact on students' education. It ranges from major benefits, to harmful risks, but if an adequate degree of control is paralleled with use of social media, then there is no strong reason for decreasing the use of social media in education.

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INFORMATION COMMUNICATION INFRASTRUCTURE IN TEACHING PROCES

The Potential Use of Cross – Platform Mobile Applications for Educational Purposes

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Abstract - Today the modern world goes mobile. The world of mobile applications is achieving the rooftop very fast. Most of the functions and tasks that were performed by the computers just two or three years ago, today are being replaced by the smart mobile devices. The educational world is trying to follow this trend; universities around the world are working hard on implementation of smart information systems and solutions in educational purposes. This paper aims to give clear guidance of the process of implementation of cross-platform mobile solutions in educational purposes. This paper presents several cross-platform modules for active student monitoring, improving the quality of teaching and automation and acceleration of the processes being executed manually. We combined few developing methods and cross-platform oriented technologies to make a proposal model for implementation of this new generation technologies in educational purposes. The advantage of the proposed model is that the model is completely platform independent and leads to shortening of procedures and reduction of certain financial costs.

I. INTRODUCTION

The main purpose of this paper is to try to propose guidelines and to generate models for implementation of advanced technologies for educational purposes.

Today in the modern world most of all the activities people perform using a mobile phone via the Internet. Mobile devices represent an essential part of the everyday life of the modern men. Everyday life of modern man is based on the rapid exchange of information. You cannot imagine progress in any area without daily, timely and rapid exchange of information.

Computer age in the last two years completely overshadowed the era of mobile devices that change the game day by day. With the expansion of mobile Internet, mobile devices have become the number one choice for consumers when it comes to everyday Internet communication and information exchange. Reservation of hotels, airline tickets, travel plans, car rental and review of attractive tourist locations are just some of the activities that users perform with the help of their mobile phones. Just a few years earlier, all these activities were conducted using a computer, but mobile devices have proven to be a much better alternative because they are much easier and handy for everyday using and above all their primary advantage is that they can be used on the go.

All this mentioned above motivated us to make a research about the potential and the possibilities of the mobile devices and their use in educational purposes. Through the implementation of the experiences of practical training which is carried out at our university, by combining multiplatform programming technologies we created several proposed models for implementation of mobile technology for educational purposes. Many researchers in the world in various fields are dealing with the advancement of the process of education through implementation of advanced technologies. Each classroom cannot have access to a computer or laptop, so, devices like mobile phones and tablets have become tools of great benefit to teachers and students.

For the purposes of this study we used a combination of Adobe technologies using Flex and Action Script 3.0 programming languages, we have created several modules for desktop computers and mobile devices in order to carry the process of interaction between students and teachers.

Within the framework of this research we used the advantages offered by social networks in order to gain an easier way of active registration of user accounts. In this paper we propose several modules. All modules are platform independent and can function equally well on all mobile devices and under all operating systems. The main goal is to offer a simple prototype system for implementation of cross-platform mobile technologies for educational purposes that would be completely platform independent, easy to use and financially tolerable.

II.   REVIEW OF THE PROPOSED MODELS

As mentioned in the introduction, we offer several models for implementation of mobile devices in the medical purposes. These models are designed as part of a prototype of a multiplatform information system for implementation of mobile technologies for educational purposes. [1]

Each model that will be explained in the text below is previously tested virtually in a realistic environment. The models are based on multiplatform programmable modules developed using Flex technology. The models are working under Adobe Air executive environment.

Within the practical testing of the software tools, a separate testing was performed in order to check the functionality of software tools for each device separately. Tests showed approximately equal speed and functionality of software tools for all mobile platforms. It is important to note that these technologies put the students in the main role allowing them faster, easier and simpler way of communication with the professor.

A. *Proposed model for implementation and integration with social networks*

Social networks have made expansion in recent years and had completely changed the perception of the Internet as a platform for communication and exchange of data. Communication and data exchange between people rose to a higher and more sophisticated level. One of the practical functions of social networks is their ability to be used as systems for authenticating users from a third party. With this capability it makes it easier for developers to work and eliminates the need to create an additional security system for authenticating users and managing databases and user accounts. [2]

This approach is greatly simplified, more accessible and interesting to students. As part of this research, a practical experiment was conducted; it involved 120 students divided into three groups. For each of the students to be able to design a drill previously had to log in via their mobile phone account with the social network Facebook, Twitter or Google account. Once the student successfully completes the login process, our database downloads personal data of the student and generates a local account.

After completing the authentication process, the student on his mobile phone receives the task in the form of a mobile application that automatically installs with a click of his mobile phone. The

exercises were unified for each individual student with specified ID for each exercise separately.

For preparation of the exercises we used JQuery Mobile in combination with Adobe PhoneGap Build to compile the exercises. For each exercise is generated Specific ID tag depending on the account on the social network which the student used to log in to the system. The format of the ID value for each exercise is particularly shown in Figure 1.
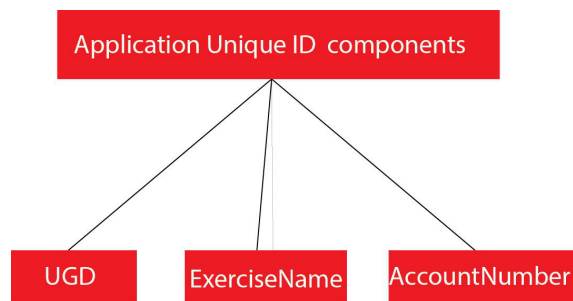
Example in XML :

```
<!-- The application identifier
<id>ugd.zadaca1.064898922</id>

<!-- Used as the filename for th
<filename>Zadaca1</filename>
```

Figure 1. Unique identifier components

From the experiment we concluded that students simplest and most reasonable social network for creating user accounts of other information systems is the social network Facebook, 75% of the announced students were announced from Facebook. Google took the second place. It is important to mention that these exercises in the form of applications are programmed for single use. After completing the exercise, students log out of the system, after checking the unique identifier becomes invalid and that exercise can no longer be used. The results of the realized exercise are saved in the local account of a student who was previously automatically generated in the database after the process of authentication.

B. *Purposed model for using the built-in device camera*

Build-in camera in mobile devices is the most popular and most used piece of hardware of all smart devices. Companies with each new model of smart device pay great attention to improving the camera. Built-in cameras in mobile phones have enormous potential for use for educational purposes, the use of the camera to achieve video conferencing

and distance learning, as a scanner to scan documents or identification of certain objects.

As part of our research we produced a prototype model for utilizing the built-in camera and use the mobile phones in educational purposes. The model consists of a programmable module that was developed using Flex technology in Java and Action Script 3.0 programming languages. The module is compatible for use on all mobile devices regardless of operating platform. The module was also tested on other tablets and has shown excellent functionality.
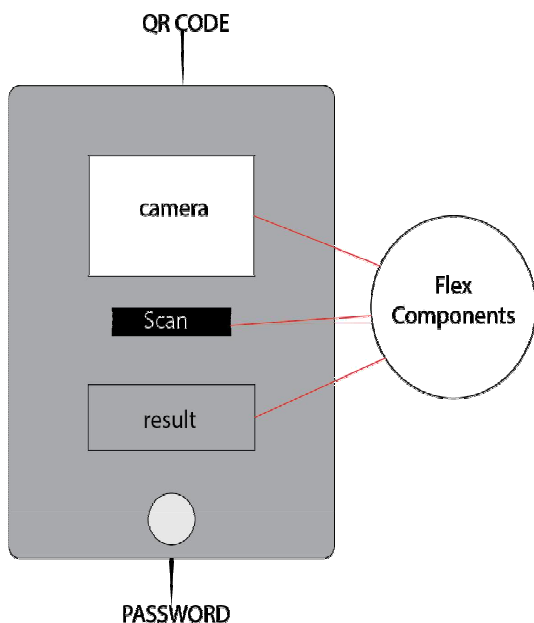
Figure 2. Visual representation of the purposed camera model

The module is consisted of integrated recognition system scan for QR codes, image recognition and text from image. As part of this research, a practical experiment was conducted in a classroom where students in the first experiment were logging using their accounts from social networks; in this experiment their task was to scan QR codes. Each student was given three images containing QR code.

By combining the content that is derived from scanned codes, students generated passwords that were used to check the results of the exercises that were developed in the first experiment. This module is technically built from Flex components that are completely based on the multiplatform technology and do not depend on the platform on which you are pursuing. Thus, the module becomes available for every smart device and do not depends on the operating system that is currently running.

In the second part of the experiment students were tasked to scan text content of the image using the built-in module within the application that can recognize text content from previously scanned images. Detected textual content was saved in PDF format with the previously build additional module for capturing PDF content. At the end of the experiment, the generated PDF files, students exchanged between themselves using a local P2P connection. For the purpose of this research previously was made a P2P module for wireless communication between students in the same classroom. [5]

Functionalities of the model:

- Scanning and recognition of QR codes

- Communication with the database using the data service for any verification of the validity of a code, if necessary.

- Scan text content for assistance in learning and recognizing text from image.

- Local P2P communication in order to exchange files and creative learning during class.

C. Module for fast and efficient electronic registration of presence

The attendance record of students can present a problem especially in larger groups of students. One of the key objectives of this research was to generate a simple draft model for fast electronic registration of students using mobile devices.

As a final goal, the system should automatically calculate the points from attending classes for individual students. Benefits from the application of such a system primary would feel the teachers because the whole thing would be done electronically without the participation of the human factor.
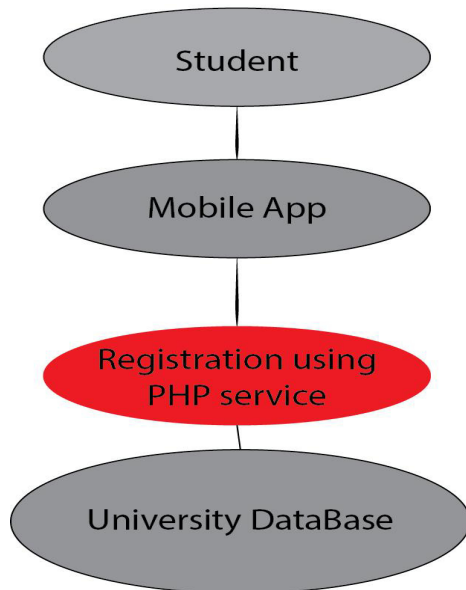
Figure. 3 Smart electronic registration of student attendance

It is important to mention that for each lesson, a new application is created with a unique identifier for that lesson. Before the beginning of the class, students by scanning the QR code are downloading the appropriate application for registration directly from PhoneGap Build cloud service and install it on their mobile phones. As part of the application that contains the module for the registration of students, additional programming module copies the IMEI code of the device from which is made the registration of attendance. For this purpose within this module is integrated data service that communicates over a P2P connection to the central database and record the attendance for each student and at the same time in the database records the IMEI code of the device from which the registration was made. After the student clicks the button presence, receives feedback message on its screen which informs that the record of attendance has been successfully completed. [3]

Within this module we implemented a possibility for electronic signature input from the student. As part of this research we were conducted an informal poll among students which was conducted electronically. The poll found 80% satisfied users from the application of these technologies in the educational purposes.

Administrative software model provides the following capabilities:

- Monitoring of students and electronic records of classes attendance.

- Generating statistics and reports in PDF format in real time.

- Importing files in XML format and update data for many of the students in real time.

- Generating electronic tasks in the form of mobile applications directly installed and valid for use only during class.

- Computer analysis and administration of the results of the exercises.

- Embedded system administration files.

- Ability to communicate directly via the built-in Chat.

D. Proposed Administration Model

Administrative work occupies a significant part of the daily activities of the professor. Electronic information and communication services nowadays provide quality and timely monitoring of student activities from anywhere at any time of day. The last proposed model in this paper is the administrative model. By combining Adobe's technologies we have created a prototype of an administrative system that is fully compatible with previous multiplatform models mentioned in the paper that were intended for students and their smartphone devices.

Administrative model should include all the above functions and collect them in a sophisticated software system that can generate electronic reports of the activities of each individual student. For the purposes of this research we have created a prototype of such software system that is intended for desktop computers. The advantage of this model is that it is completely independent of any operating system. The software was tested on a Windows operating system and the computer with Mac OS X operating system. On both computers the software showed equal efficacy.

Figure. 4 Part of the administration module
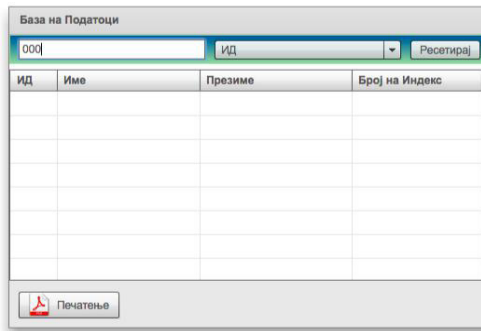
Figure. 5 Administration module: SearchBox

III. CONCLUSION

Within this short research in this paper we presented four proposed models for the implementation of advanced multiplatform technologies for educational purposes. All models are tested virtually in a realistic environment and provide excellent initial results. For implementation and repeated use of these proposed models, is needed further testing and upgrading. The main advantage of all the proposed models is that they are completely independent of platform, device and operating system on which they run. With the implementation of these proposed models, a complete information system can be created which would be used for educational purposes. At the same time this system would be acceptable and compatible with all scientific institutions and each information infrastructure. The application of this model, significantly reduce financial costs because of the use of one platform for all devices and it can be adapted to the existing infrastructure.

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Using the Computer Graphics Means in the Training of Future Technologies and Entrepreneurship Teachers

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Abstract - The processes of informatization and computerization in the equipment and technologies caused the necessity for formation of information culture in the new generation.

In the article a stress is put on the necessity of use of the latest information technologies in training teachers. An important place in the training is using computer graphics which is conditioned on the necessity for improvement of vocational training, especially for training teachers in technologies and entrepreneurship which is directed towards acquiring knowledge and skills from various fields of human activity. In relation to this, forming information culture in future teachers is a priority.

I. INTRODUCTION

In the state educational standards for higher vocational education in the field of training teachers with profile "Technologies and Entrepreneurship" determined are the basic requirements for this degree of education, expressed in the competences, several of which are: students to design, model and structure, plan and execute small projects, design objects as per instructions and template, to develop sketches, technical drawings. [1] Utilizing these competences gives opportunity processing information means to be used in the school process in various methods. Computer technologies' development affect the selection of such means, most significant of which are the computer graphics technologies.

The article puts a stress on the necessity of using the latest information technologies in training future teachers. On the grounds of the analysis of scientific and pedagogical researches determined are the most perspective fields for application of computer technologies in training future teachers in technologies and entrepreneurship, among which an important place is the use of computer graphics. Opened is an opportunity for effective use of graphic design computer means, for enhancing the activation and efficiency of school process, more specifically at the stage of visualization of the designed site.

Nowadays observed is an active process of developing informatization which characterizes with broad introduction of contemporary information technologies in various fields of human activity. Informatization of contemporary society has caused a change of professional activities in relation to introducing new information technologies (IT) which, on its part, changes the approaches for training experts in various sectors of production. Marked shall be that during recent years observed are various transformations in the field of project activities related to active use of IT in the structure of professional work of designers as well as occurrence of new types of design (industrial design, interior design, fashion design, multimedia design, graphic design, web design).

Along with the traditional occupations which require knowledge in the field of computer graphics such as engineer, architect, designer, new occupations occur which are profitable, interesting and are related to development of computer technologies: "Graphic designer", "Computer graphics", "3D visualizer", "3D animator", "3D modeler", "3D designer" and others. All new occupations require a new type of education. This way, with the growing demand of computer-related major – computer graphics, many students, after their graduation choose a major directly or indirectly related to use of computer graphics. This is why supplementary education of students in this direction will help them choose their future occupation.

II. TOPICALITY

The active introduction in the school process of material with project character in the educational programs of technical training of contemporary

school requires the right preparation of the technologies and entrepreneurship teacher for the presentation and organization of the artistic activity of students. In the context of global information society – using computer technologies in the process of implementation of those tasks.

According to the reform in the education in Bulgaria significant attention is paid to forming the artistic abilities of the separate student and more specifically in the process of training in technologies and entrepreneurship. This situation requires appropriate technologies for training teachers. Nowadays the teacher in technologies shall prepare artistic personalities who shall have the necessary level of artistic and designer skills.

According to "Strategy for the effective application of information and communication technologies in education and science of Republic of Bulgaria (2012-2020)" [2] necessary is to resolve the problem of developing methods for efficient and reasoned use of information and communication technologies (ICT) in the education process which leads to obtaining significant educational results. The effective use of ICT suggests that:

- significantly shortened are the time and other expenses for students in the educational process for solving one task or another;

- increased is the visibility, the emotional intensity of the educational activity, the motivation of learners;

The introduction of ICT will lead to creating in the educational institutions of new atmosphere where most important elements are the cult to knowledge and critical thinking. Such atmosphere may be obtained as result of the overall system of actions close and understandable for all participants in the educational process.

Upon review of the academic contents of curriculum in technologies and entrepreneurship [3] for various grades evident are many topics where used would be knowledge in computer graphics obtained by students upon their training. For example in a competence field – construction and modeling evident is the leading role of graphics image of the structure as a stage of creating an object. In the competence field – design, planning and assessment of technological processes and sites necessary is knowledge about the methods of display of internal surfaces, display of cuts, sections of details with a simple geometric shape, fabrication of sketches, preparing a sketch of an object with simplified structure and others.

III. EXPOSITION

Necessary is to determine the most perspective fields of computer technologies and more specifically computer graphics in the process of training students, future teachers in technologies and entrepreneurship as well as disclosing opportunities for the effective use of computer means for graphic design for increase of the activation and efficiency of the school process in "Engineering and Computer Graphics" in training teachers. The process of modernization of vocational training determines the necessity of quality changes in the system of vocational – graphics training of those graduated higher institute. The technologies and entrepreneurship teacher holding vocational competence shall be freely oriented in information and education area, shall develop innovative approach for the organization of graphics and technological training of the students, guaranteeing the efficiency of the use of contemporary educational technologies in education. The education process in the system of vocational-graphics training is designated to promote the cognitive activity of students, to increase their intellectual, cultural and moral values, norms of behavior, forming personality of the contemporary teacher.

In the context of organization of education activities necessary is to determine:

- the essence of the notion "information technologies";

- the main directions for introducing computer technologies in the school process;

- the necessity of using computer graphics in the system of informatization of the educational process when training the future teachers in technologies and entrepreneurship.

Solving those problems will contribute to the purposeful work on forming vocational competences, ensuring high quality training for technology and entrepreneurship teachers.

As explanation of the term "Information technologies" (IT) appropriate is the definition by the Information Technology Association of America stating that (IT) is actually the learning, creating, development, toolbox, maintenance and management of computer-based information systems.

Information technologies (IT) are a group of technologies designated for collecting, processing, storing and distribution of sound, graphics, text and

digital information and using for that purpose a mix of computer and telecommunication equipment based on microelectronics. [4]

The notion "information technologies" in its contemporary sense was used for the first time in 1958 in an article in Harvard Business Review, where the authors Harold Leavitt and Thomas Whistler state that "new technology still has no specified name. We will call it information technology (IT)". [5].

Because processed information is most commonly in a discretized form, information technologies sometime are called digital. Due to the important role of communications in the contemporary means of processing information often used are the wider notion information and communication technologies.

The analysis of various approaches to the concept of determining the notion "information technologies" made possible the formulation of the definition. In compliance with this, "IT in education" is reviewed as an important innovative branch of pedagogical science which studies the didactic potential of information and communication means and their systematic use in the school process with the purpose of increase of its efficiency.

Now the problem for computerization in the field of higher education is actively discussed by leading psychologists, teachers, methodists. Basic results from the many researches in this field of science are reflected and diligently described in the psychological and pedagogical literature of many scientists.

Introducing technologies in education shall not be a self-purpose and is fully meaningless if there is no clear plan and strategy for their application and completion of educational competences. [6]
Marked shall be that contemporary IT actively effect the educational process, gradually changing its contents and technology of education, especially in the process of preparation of experts, the vocational activity of which is related to artistic and design activity, skill for use computer for graphics display of results of work, visualization of scientific data (creating illustrations, diagrams, sketches, schemes for developing projects, 3D modeling and others) for geometric design and modeling, for graphics advertising, web design, video films, creating drawings, multiplication, processing photos and so on.

Accent in information technologies is on utilization of technologies – knowing and understanding work with determined programing products and specific means and approaches for processing information. Mainly the attention is directed towards development of project knowledge which indicate not only the end result but also the methods of its achievement.

Computer graphics is a share of computer sciences which studies the methods for digital synthesis and processing of visual contents. Computer graphics reviews the methods and means related to creating, conversion and reproduction of graphics images. Those methods and means are applied with the assistance of specialized programs called graphics editors. They hold a selection of tools for free-hand painting, drawing geometric figures, filling in contours, tools for editing and processing images.

Computer graphics encloses several sub-fields: 3D computer graphics and more particular rendering of three-dimensional scenes in real time (often used in computer games), computer animation, special effects (often used in movies and television), images processing and geometric modeling (often used for engineering purposes). Computer graphics is a type of symbiosis of knowledge in the field of equipment and esthetics of painting, composition, technical graphics and the possibilities of contemporary computer technologies.

Thanks to the wide application of information technologies in various fields of human activity the specter of using computer graphics is very diverse, namely in:

- scientific and development activity – modeling (simulation) of complex events and hardly-foreseeable situations, researches of multi-factor processes in various branches of science and technologies; demonstration of experiment's results (building graphics, diagrams and so on);

- project and constructor works – visualization of results of the inventory design, design, construction and modeling of technical sites through automated design of graphics documentation (sketches, diagrams and so on);

- designer activity – development of projects' design, creating graphics compositions, formatting printing material (retouching images, creating and editing collages, color and shade adjustment of images and so on);

- computer animation and multiplication – modeling of animated objects, creating multiplication movies and advertising, editing of video files and so on.

At the moment computer graphics is widely used in training experts in various fields, including technologies and entrepreneurship teachers. Main objectives of the research of computer graphics opportunities in studying engineering and computer graphics is to attract students to work with modern graphics programs, gaining project knowledge and skills, developing the artistic potential.

Taking into consideration the specifics of the scientific research-related problems as well as for the successful solving of problems, we consider necessary researched to be the possibilities for using computer graphics in the field of design which may be reviewed as some kind of symbiosis serving as a basis for training artistic design to future technologies teachers.

By using computer graphics means solving the problem of the graphic design is much easier than with the conventional method. On one hand the image is easily editable, on the other hand compared may be various images as sufficient is to keep sketches of the future project in many files through multiple copy and made is a change of the object at every two copies. This establishes significant advantages: there is no restriction of the paper size or the working plot; an opportunity is given to generate many ideas and options for artistic solution for eliminated is the necessary of re-drawing contours of the output elements of the design; an opportunity is given for change, perfecting of the form, color of the object and design.

An important advantage of computer graphics is the opportunity for introducing the subject of design in a form most closely to the actual one which is achieved thanks to photorealistic reproduction of its smallest components. For example upon visualization of the design through the three-dimensional computer graphics means, comparatively easily ensures is multi-plan presentation of the space shape of the object for it is located in a special virtual environment which has the properties of the actual space.
Computer graphics provide wide opportunities for increasing the efficiency of the design process of complex technical sites.

The computer is an irreplaceable tool in the graphic design, regardless whether there are disputes whether computers limit the creativity of designers.

Some designers continue to use manual and traditional tools in their projects which again prove that computer programs make the best design. It is known that the design process of a certain site is precondition on the creating a model of the future product which gives an image of its shape, appearance, functional characteristics and then developed is appropriate constructive graphics documentation. Marked shall be that significant advantage in the use of computer graphics is the tools used mainly at the stage of visualization. Used are various techniques for applying texture to the surface of the material different than the classic graphics tools: application of gloss, paint, tinting, texture imitation and more.

Visualization of the design site in the area of graphics editor ensures successful solving of various problems related to the harmony of colorful solutions, texture with the necessary constructive materials, integrity and unity of the graphics image, clarity of the artistic design site. Using technology of computer graphics suggests helps ensure a realistic view of the artistic project through using various textures and materials which cannot be obtained through conventional means. Also shadow of the object may be automatically placed depending on the position in the virtual space and parameters of the lighting source.

In the computer technology results of design activity are registered as graphics files of various kinds. They may be indicated on the screen of a monitor at all times and are more informative compared to sketches and drawings made by hand or using tools for drawing and painting. At the same time the relative lightness of the object's transformation of design allows creating objects for short period of time with a larger number of possible solutions of design assignment.

This is why for achieving specific results of the artistic design activity possible is to assess preliminary created options and the necessary corrections to be made. Also with the help of the multimedia animation indicated may be details from all sides, for clarifying the internal shape used are cuts indicating in the dynamics how the secant plane cuts the detail and removes the part located between the observer and the secant plane. Visualization of this process may be completed with a drawing of the detail prior to or after making the cut. In the study of engineering and computer graphics with the assistance of animation effects demonstrated may be the sequence of design of special geometric objects on the projection planes, clearly evident is what the

mutual location of the geometric shapes is in the space and their projection on the plane. Using computer in the academic process is not only a mean for facilitation of graphics work's implementation but also as mean for facilitation of the understanding of the methodic for structuring drawings.

IV. CONCLUSIONS

In relation to the aforementioned computer graphics shall be reviewed as a special branch of informatics, subject of research about the combination of methods for creating, processing and picturing artistic graphics information via the use of computer technology as well as presentation of this information for further use.

Using computer graphics means in training of future technologies and entrepreneurship teachers shall be directed towards achieving the following goals:

- Contributing to the self-determination of the student and/or selection of future career;

- Creating positively motivated training in selected profile;

- To familiarize students with activities leading for this profile;

- Strengthening of the cognitive activity of students;

- Enhancing the information and communication competence of students.

Perspective for further research issues raised in the article may be the development of the overall selection of methodic materials in assistance of the training in discipline "Engineering and Computer Graphics" for students in "Technologies and Entrepreneurship" by taking into consideration the current condition of the computer graphics and the tendencies in its development.

Part of solving the problem is the motivated selection of software product for training in "Engineering and Computer Graphics".

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[10] Innovations in education: Where is Bulgaria as oppose to the world?

Elevator Control by Android Application

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Abstract - This paper presents android application for the elevator control. We will analyze the ways of elevator calls: regular call, priority call and voice call, as well as interface as a link between smartphones and elevator control panel. Furthermore, we will show the design of the application which stimulates control panel for the elevator call and interface which will receive signals, process them and send them to the main elevator control panel.

I. INTRODUCTION

Nowadays, almost every smartphone owner tried to take control over the processes or devices using their smartphones. If such a control is implemented on the elevator, it can shorten the waiting time, make voice elevator calls when your hands are busy and "make the elevator reservation" at certain time. In some institutions, such as hospitals, we could implement this interface especially in emergency cases where even a little delay in the movement can lead to fatal consequences for the patient's life. With this type of interface we can save time of waiting for the elevator in a way that it will be set in the doctor's private mode which will ensure that the elevator will be on the right floor at the right time and that it will wait for the approval for its further movement. Furthermore, in luxury hotels "the elevator reservation" at certain time could become very interesting from the aspect of the customer service. If we take into account that this interface can operate the elevator, then for sure it can be used to control and operate other processes and devices. According to this, with the single application we could control the whole building, house or factory.

II. ELEVATOR CONTROL

Observing the elevator functionality as a process, the elevator control and operation do not seem complicated. However, the logic of the elevator is simple, but its complexity depends on how many floors the building has. Taking into account that every floor must have minimum of four sensors, which functions are pre-stopping (soft stopping), final stopping, centering the elevator on the exit and the floor determination, it is obviously

a complex process and proportionally to this fact the process becomes more complex with increasing the number of floors. The control panel of this type of the elevator has PLC (Programmable Logic Controller) which must have the same number of digital inputs as floors, additional digital inputs for sensors and safety systems. A simple example of the logic that is written in the PLC is shown in Figure 1, which is directly related to the sequence of sensor readings on a given floor.
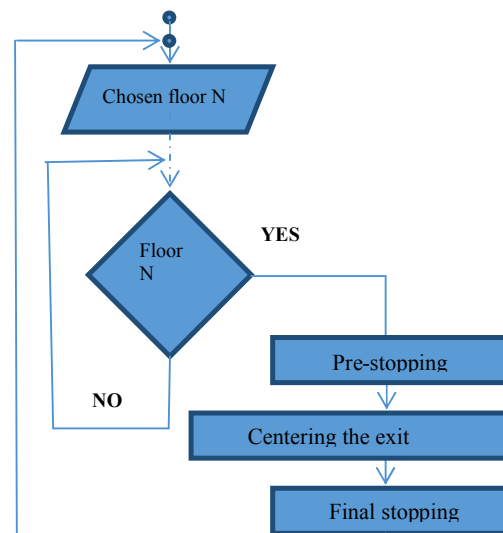
Figure 1: The sequence of sensor readings

As mentioned above, the control panel works with digital inputs and outputs, although some signals are received as analogue, it coverts them to digital by doing galvanic isolation with the help of the relay.

The buttons for the call placed inside and outside of the elevator work on the same principles, they are connected to the same input control panel. Taking into account this fact and given that the electronic circuits are galvanically separated, we can come into conclusion that the number of call buttons for one floor is unlimited and that the way

in which the electronic circuit is closed will not affect the operation of the system.

III. ELEVATOR CONTROL BY ANDROID APPLICATION

Guided by everything that was said above, it can be concluded that the control with the android application would indeed be possible with the interface whose outputs are connected in parallel to the inputs of call buttons. Function of such interface would be to stimulate the signals which the elevator control panel gets at its inputs. It also requires the network structure for the communication between the smartphone and the controller.

IV. EXAMPLE SOLUTION TO THE PROBLEM

Interface, network structure and application are required for the elevator control through the android application.

A. Interface

Interface – is consisted of Ethernet female connector and the microcontroller (PIC, AVR, Arduino system). The interface function is divided into two parts. The role of the first part is to be a TCP server and the second one to process the received data and send it to the control panel. TCP server can be made by placing a TCP / IP stack in the microcontroller, setting the IP address and port and constantly listening if the information is received via the network. If the data is received, it is stored in the variable, and based on it the floor is determined, the feedback that the order is executed is received and the signal is sent to the control panel (Figure 2).

The microcontroller needs to have as much outputs as the control panel input buttons. Furthermore, the microcontroller outputs are connected in parallel to the control panel inputs. For example, the output for the first floor with the microcontroller connects in parallel to the existing call button for the first floor. Scheme of the connection is shown in Figure 3. It is necessary to make an exit with a microcontroller that will be connected in parallel to the control panel switch in the elevator, which has a role to stop the elevator (this is necessary in case of the priority call).
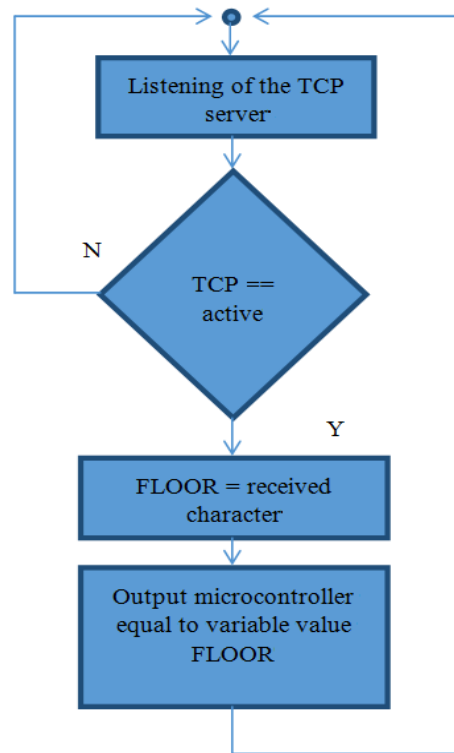
Figure 2. Interface logic
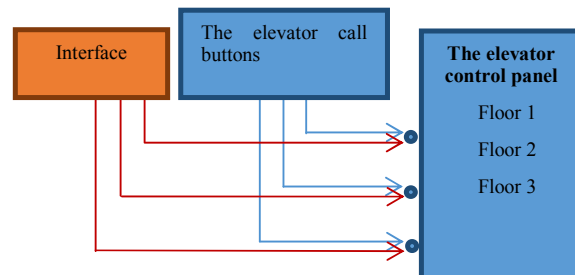
Figure 3. Scheme of the interface connection to the elevator control panel

B. Network structure

Network structure – should be done in a way that each floor has its own access point whose SSID will be a number of the floor where it is (e.g. 1st floor should be labeled as "1") and all of them are connected to the router where it joins the interface with the help of UTP cable. It will function by making the wireless on smartphone automatically to choose a wireless network with the strongest signal and in the case of the call with the application as floor number the SSID will be sent, i.e. the floor number where the caller is located.

C. Android application

Android application – should be created in a way that it can perform three types of calls: regular call, priority call and voice call. Furthermore, it must send everything to IP address and TCP server port located in the interface. With the regular call, the application should have a button which would be named "Call the elevator", and when the button is pressed it takes the SSID name from the access point to which the smartphone wireless connection is connected and forwards it to the interface, which will process the information and call the elevator.

Taking into consideration the priority call, it is immediately thought of the users with privileges. They would be received the generated code by the operator to enter it in the application in order to unlock the priority mode. Function of the priority mode is that the user can call the elevator to wait for him/her locked for the other users until the command is sent with the same application on which floor he/she wants to go or until the session time expires. In this mode interface must have its own internal protocol because programs are executed sequentially in the microcontroller, the user will be assigned with the ID when enters the priority mode and only the user with this ID will be able to operate it. The phrase 'elevator lock' refers to the following: if we make the priority elevator call, the interface will send a signal to the control panel to turn on the option "STOP" (this option is available in elevators – when they operate on regular basis and it can be turned on by anyone even without the application) and it will be turned off automatically when the user chooses the floor or in case of the expired session. When the user makes the elevator call marked with priority and button "Call the elevator", on the mobile phone display should appear the keyboard with numbers as much as the building has floors and upon entering the elevator the user should click on the floor he wants to go.

If we want to make a voice elevator call we need another TCP server which can be crated on the computer as a program and which would have the main role to filter the words such as "first" etc. The server will change back these words to "1" so that the application forwards that number to the interface as a call.
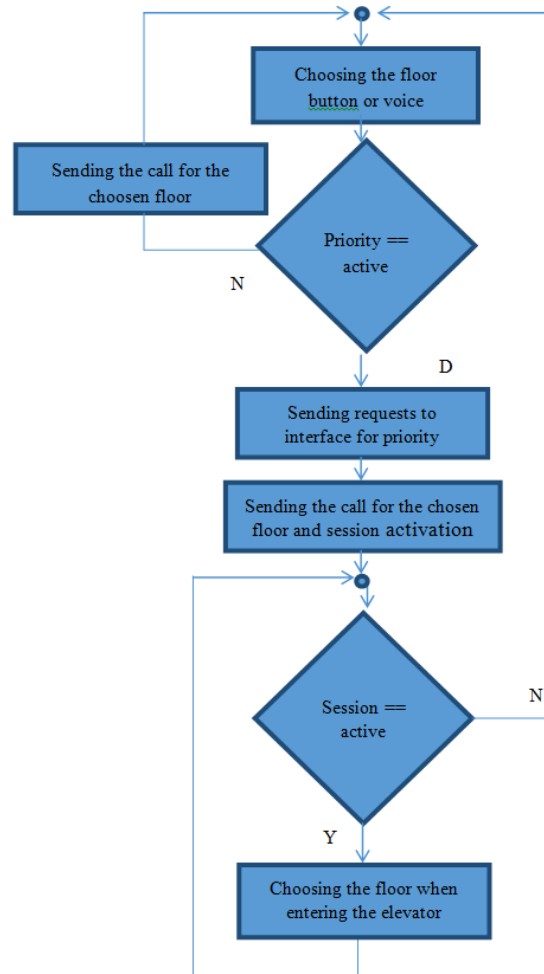
Figure 4. The logic of the application

V. CONCLUSIONS

In the previous research it can be seen that we could shorten the elevator waiting time by making a call while moving towards it. Another important fact is that it is possible to implement such an interface to an existing elevator control panel without any additional investments, changes or affecting the operation of the elevator control system itself.

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Benefit of Using Shared Memory in Implementation of Parallel FWT Algorithm with CUDA C on GPUs

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Abstract - GPUs have different memory hierarchy than CPU and with their proper use, we can achieve effective implementation and improve the performance. In this paper we discuss how to use shared memory on GPUs and how does it affect the implementation and performance. For a more detail clarification of benefit of using shared memory, we take into account parallel algorithm for calculation of the Walsh spectrum on graphics processor unit (GPU) and its parallel implementation in CUDA C. Using shared memory is a good optimization strategy, which gives faster time of execution of the parallel program.

I. INTRODUCTION

Challenge of modern computer architecture is building fast computation model and for that data movement must be fast. In addition, is needed lot of memory for big applications and fast computation for big data can be very expensive.

Memory hierarchy must be considered when we write the parallel code. Execution speed relies on exploiting data memory locality. Here we will explain the memory model and how it can be exploited to obtain better performance.

The use of modern graphics processing units (GPUs) has become attractive for scientific computing which is due to its massive parallel processing capability. Modern GPUs are more than very efficient device use for rendering the graphics and accelerate the creation of images. Their highly parallel structure makes them more effective than general-purpose CPU for algorithm where processing of large blocks of data is done in parallel [1] [2]. Compared with multi-core CPUs, new generation GPUs can have much higher computation power and memory bandwidth. Therefore, they are attractive in many application areas. One of the most important application domains is the linear algebra [3] [4].

The purpose of this paper is to assess the performance of the recent, inexpensive and widely used NVIDIA GPUs in performing Walsh Transforms. Our approach for the calculation of the Walsh spectrum is a Fast Walsh Transform and briefly, we will describe the mathematical background below in this paper. First, we will show the basic algorithm which can be easy to implement using the shared memory and we will show how this algorithm can affect the performance.

A. Overview of this paper

In Section II we give a brief introduction in GPU Computing model with CUDA. In Section III we present the mathematical background for a Walsh transform. In Section IV we explain the basic Algorithm and Algorithm with shared memory. We summarize the results in Section V and give some conclusions.

II. GPU COMPUTING MODEL WITH CUDA

GPUs are designed for efficient execution of thousands of threads in parallel on as many processors as possible at each moment. The computation processes are divided into many simple tasks that can be performed at the same time. This intensive multi-threading allows execution of various tasks on the GPU processors while data is fetched from or stored to the GPU global memory. It also ensures the scalability of the GPU computing model, since processors are abstracted as threads, and support parallel programming model [5].

A. CPU versus GPU

A simple way to understand the difference between a CPU and GPU is to compare how they process tasks. A CPU consists of a few cores optimized for sequential serial processing while a GPU has a massively parallel architecture consisting

of thousands of smaller, more efficient cores designed for handling multiple tasks simultaneously. This ability of a GPU with hundred and more cores to process thousands of threads can significantly accelerate the software over a CPU.

B. The CUDA programming model and hardware interface

Modern NVIDIA GPUs are powerful computing platform developed for general purpose computing using CUDA (Compute Unified Device Architecture) [6]. It allows programmers to interact directly with the GPU and run programs on them, thus effectively utilizing the advantages of parallelization. Depends of architecture CUDA cores can be organized into SMs (streaming multiprocessor), each having a set of registers, constants and texture caches, and on-chip shared memory as fast as local registers (one cycle latency). At any given cycle, each core executes the same instruction on different data (SIMD), and communication between multiprocessors is performed through global memory. As a programming interface, CUDA C is not a new language, it is a set of C language library functions with GPU specific commands, options and operations [7], and the CUDA-specific nvcc compiler generates the executable for the NVIDIA GPU from a source code.

Data-parallel functions are written in units called kernels which execute over the stream of data by many thread on a device in parallel. Thread is a process that performs series of independent programming instruction and is single instance of the kernel. Creating and destroying of thread barely requires resources (time), from where come that they don't have any significant impact of the performances. Threads are organized into blocks, which are sets of treads that can communicate and synchronize their execution. It can launch maximum 1024 threads (512 threads for older GPU) per block. Block are executed by single SMs, depending on the specific GPU hardware, a SMs can execute multiple blocks simultaneously [5]. Block and thread per block form a grid.

C. Memory hierarchy

It must to consider memory hierarchy while write parallel code. Execution speed relies on exploiting data locality. Lowest level memory is the faster which itself is more expensive and smaller (limited). Registers are the fastest followed by local memory, shared memory and global memory. Every thread has access to his local memory. Data in share memory can share between every thread of the same block. All threads from all kernels can access to

global memory. Since blocks execute in an arbitrary order, if one block modifies a data element, no other block should read or write that data element in global memory. Except these types of memory, there are additional memory and variable types. Constant can only read and reading it is almost fast as a reading from register. Texture memory originally, intended primarily for pure graphics applications.

There are several benefit from using shared memory, they can use for operations who requiring communication between threads, it is useful for data re-use, it is alternative for local memory, it reduces use of registers when a variable has same value for all threads.

Memory model shows interaction of the threads and there is a chance thread to read result from computation before other thread to write (compute) or with other words we can obtain incorrect result. Consequently, usually thread synchronization is needed to ensure correct use of the memory. Instruction __syncthreads(); inserts a "barrier" synchronization no thread in a block is allowed to proceed beyond this point until the rest have reached it. Global synchronization of all threads can be performed across separate kernel launches or with Fast Barrier Synchronization [8].

III. LINEAR BOOLEAN FUNCTIONS AND WALSH SPECTRUM

Let $f(x) = u_1 x_1 \oplus u_2 x_2 \oplus \ldots \oplus u_n x_n$ be a linear Boolean function of n variables. We use the notation $u_1 x_1 \oplus u_2 x_2 \oplus \ldots \oplus u_n x_n = x^{(\oplus u)}$. The binary n-dimensional vector u uniquely defines $f(x)$ and therefore we denote it by $f^{(\oplus u)}(x)$. The Truth Table of $f^{(\oplus u)}(x)$ has the form

$$\begin{pmatrix} f^{(\oplus u)}(\overline{0}) \\ f^{(\oplus u)}(\overline{1}) \\ \vdots \\ f^{(\oplus u)}(\overline{2^n - 1}) \end{pmatrix} = \begin{pmatrix} \overline{0}^{(\oplus u)} \\ \overline{1}^{(\oplus u)} \\ \vdots \\ (\overline{2^n - 1})^{(\oplus u)} \end{pmatrix} = (S_{mat}^{(n)})^{(\oplus u)}$$

The values of the linear functions for $\overline{0}, \overline{1}, \ldots, \overline{2^n - 1}$ form the following matrix:

$$H_n^+ = \begin{pmatrix} \overline{0}^{\oplus \overline{0}} & \overline{0}^{\oplus \overline{1}} & \cdots & \overline{0}^{\oplus \overline{2^n - 1}} \\ \overline{1}^{\oplus \overline{0}} & \overline{1}^{\oplus \overline{1}} & \cdots & \overline{1}^{\overline{2^n - 1}} \\ & & \cdots & \\ (\overline{2^n - 1})^{\oplus \overline{0}} & (\overline{2^n - 1})^{\oplus \overline{1}} & \cdots & (\overline{2^n - 1})^{\oplus \overline{2^n - 1}} \end{pmatrix}$$

Hence

$$H_n^+ = \left((S_{mat}^{(n)})^{\oplus \bar{0}}, \quad (S_{mat}^{(n)})^{\oplus \bar{1}} \quad ,..., \quad (S_{mat}^{(n)})^{\oplus \overline{2^n-1}} \right)$$

$$= \left(\begin{pmatrix} 0S_{mat}^{(n-1)} \\ 1S_{mat}^{(n-1)} \end{pmatrix}^{\oplus \bar{0}} \cdots \begin{pmatrix} 0S_{mat}^{(n-1)} \\ 1S_{mat}^{(n-1)} \end{pmatrix}^{\oplus \overline{2^{n-1}-1}} \cdots \begin{pmatrix} 0S_{mat}^{(n-1)} \\ 1S_{mat}^{(n-1)} \end{pmatrix}^{\oplus \overline{2^n-1}} \right)$$

For the matrix H_n^+ we have

$$\left(\left(0S_{mat}^{(n-1)} \right)^{\oplus \bar{0}} \cdots \left(0S_{mat}^{(n-1)} \right)^{\oplus \overline{2^{n-1}-1}} \right) =$$

$$\left(\left(1S_{mat}^{(n-1)} \right)^{\oplus \bar{0}} \cdots \left(1S_{mat}^{(n-1)} \right)^{\oplus \overline{2^{n-1}-1}} \right) = H_{n-1}^+,$$

$$\left(\left(1S_{mat}^{(n-1)} \right)^{\oplus \overline{2^{n-1}}} \cdots \left(1S_{mat}^{(n-1)} \right)^{\oplus \overline{2^{n-1}}} \right) = \overline{H_{n-1}^+},$$

where the matrix $\overline{H_{n-1}^+}$ is obtained from H_{n-1}^+ after replacing 0 by 1 and 1 by -1. It follows that

$$H_{n-1}^+ = \begin{pmatrix} H_{n-1}^+ & H_{n-1}^+ \\ H_{n-1}^+ & \overline{H_{n-1}^+} \end{pmatrix}, H_1^+ = \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix},$$

$$H_2^+ = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 \end{pmatrix}.$$

It is easy to see that H_n is a symmetric matrix. Its rows (and columns) form n dimensional linear space. In coding theory this space (without zero coordinate) is known as a simplex code. This space together with its coset with representative $(11 \ldots 1)$, form the first order Reed-Muller code.

Let $a = (a_1, a_2, ..., a_m)$ be a binary vector. The polarity representation $a^{(p)}$ of a is obtained from a after replacing 0 by 1 and 1 by -1. Consider the scalar product $s = a^{(p)} \cdot b^{(p)}$ over the integers. Let s^- (respectively s^+) be the number of the coordinates, for which $a_j^{(p)} b_j^{(p)} = -1$ (respectively $a_j^{(p)} b_j^{(p)} = +1$). Then $s^- = d(a,b)$ is the number of coordinates with different value for a and b. And s^+ is the number of the coordinates with equal values for a and b. We have that $s = s^+ - s^-$ and $m = s^+ + s^-$ or

$$s^- = (m+s)/2, s^+ = (m+s)/2.$$

Let us denote by $PTT(f)$ and H the polarity representations of $TT(f)$ and the matrix H^+. The vector

$$W_f = H \cdot (PPT(f))^t =$$

$$(f^w(\bar{0}), f^w(\bar{1}), ..., f^w(\overline{2^n-1})), W_f = (W_0, ..., W_{2^n-1})$$

is called Walsh spectrum, and the function $f^w(\bar{a})$ defines the Walsh transform. The value W_i determines the distance between the Truth Table of f and the Truth Table of the linear function $x^{\oplus i}$, which is equal to $(2^n - W_i)/2$, and the distance between $TT(f)$ and the Truth Table of the affine function $1 + x^{\oplus i}$ which equal to $(2^n - W_i)/2$.

Matrix vector multiplication $H \cdot (PPT(f))^t$ can be given by a butterfly diagram and a corresponding algorithm, namely Diagram 2 and Algorithm 2 [8]. This algorithm passes all elements of the matrix $S_{mat}^{(n)}$ in n steps column by column starting from the last one. Depending on the value in the i-th row and $(n-j+1)$-th column of the matrix $S_{mat}^{(n)}$ the algorithm calculates a new values for $W_f[i]$ and $W_f[i + 2^i]$. This algorithm entirely depends on the binary representation of the nonnegative integers smaller than 2^n.

Fast Walsh Transform can be implement parallel, by using base concept on Algorithm 2 [9] but with acceptable modification to be suitable for parallel implementation. For our parallel implementation, we use CUDA C and we make several versions where we use various optimization techniques, model and different memory to get better performance and efficiency.

IV. PARALLEL ALGORITHMS

In introduction, we mentioned that we would show basic algorithm for Fast Walsh Transform and then improvements with using of shared memory. These algorithms are implemented in CUDA C.

The basic algorithm (Algorithm 1) is based on the sequential Algorithm 2 [9] but with suitable modification in order to implement it in parallel. Below is shown pseudo code from parallel implementation of the Algorithm 1 of Fast Walsh Transform.

Algorithm 1. Parallel implementation of FWT

Input: The Polarity Truth Table PTT of the Boolean function f, with 2^n entries

Output: The Walsh spectrum W_f of the Boolean function f, with 2^n entries

// Allocate memory for device copies and host copy

// Copy inputs to device

// Set grid of block and thread

$j \leftarrow 1$;

$r \leftarrow 0$;

$W_f \leftarrow PPT$

while $(j < 2^n)$ do

$\quad r \leftarrow r + 1$;

$\quad$ **fwt_kernel(W_f , temp, r, j)** /*Launch kernel*/

$\quad j \leftarrow j \cdot 2$;

end while

// Copy result back to host

// Cleanup memory

---

fwt_kernel(W_f , temp, r, j), Kernel, Algorithm 1

---

fwt_kernel(W_f , temp, r, j)

$i \leftarrow$ thread // Set index of the thread

value $\leftarrow 0$; //Local variable for every thread

if(r−(r/2)∗2==1) then /*(r%2==1) Save intermediate results*/

$\quad$ if($i_{[n−j+1]} = 0$) then / ∗ if((i&j) == 0) ∗ /

$\quad\quad$ value $\leftarrow (W_f[i]+W_f[i+j])$;

$\quad$ end then

$\quad$ else

$\quad\quad$ value $\leftarrow (−W_f[i]+W_f[i−j])$;

$\quad$ end else

$\quad$ temp[i] $\leftarrow$ value;

end then

else

$\quad$ if($i_{[n−j+1]}$=0) then / ∗ if((i&j) == 0) ∗ /

$\quad\quad$ value $\leftarrow$ (temp[i]+temp[i+j]);

$\quad$ end then

$\quad$ else

$\quad\quad$ value $\leftarrow (−$temp[i] + temp[i − j]);

$\quad$ end else

$\quad W_f[i] \leftarrow$ value;

end else

Kernel (**fwt_kernel**) from the Algorithm 1 takes the following as input:

- array W_f where to put Polarity Truth Table PTT of the Boolean function f, with 2^n entries

- array temp with 2^n entries, initialized to 0

- variable r initialized to 1, used for tracking where to put result, prevention of rewriting the memory

- a variable j initialized to 1, used for tracking the step and specifying array index

and return the array W_f with 2^n entries, complete Walsh spectrum W_f of the Boolean function f.

This algorithm passes all elements of the matrix $S_{mat}^{(n)}$ in n steps column by column starting from the last one. Depending on the value in the i-th row and (n−j+1)-th column of the matrix $S_{mat}^{(n)}$ the algorithm calculates a new values for $W_f[i]$ and $W_f[i+2^i]$. This algorithm entirely depends on the binary representation of the nonnegative integers smaller than 2^n [9].

Problem is synchronization of threads from different blocks (global synchronization). We performed global synchronization across separate kernel launches. This process doesn't affect program performance because creating and destroying of thread barely requires resources (time). For one-step of computation, the data is read from memory, compute and write new compute data. Every thread according index and location in the block take two memory elements make computation and result write back in the particular memory location.

Except the problem with synchronization, another problem is type of memory used. Global memory is the slowest memory on GPU. With using of shared memory, we want to reduce the problem.

Algorithm with shared memory we combine with memory pattern and we have two kernels. First kernel use shared memory for calculations until

certain steps. Because it can launch maximum 1024 threads per block and data is shared between every thread from same block, with shared memory kernel we can calculate until 10 step FWT algorithm (or less steps for less PTT size, element). Below it shown pseudo code from parallel implementation of the Algorithm 2.

Algorithm 2. Parallel implementation of FWT

Input: The Polarity Truth Table PTT of the Boolean function f, with 2^n entries

Output: The Walsh spectrum W_f of the Boolean function f, with 2^n entries

// Allocate memory for device copies and host copy

// Copy inputs to device

// Set grid of block and thread

sizeblok ← size/1024 /* if size > 1024 */

sizethread ← max 1024; W_f ← PPT

/*Parallel function, shared memory, Algorithm 2*/

    fwt_kernel_SM(W_f, temp, sizethread)

    if (size > 1024) then

/*Parallel function, memory pattern, Algorithm 2*/

fwt_kernel_SM_MP(temp,$W_f$result,sizeblok)

    end then

// Copy result back to host

// Cleanup memory

---

    fwt_kernel_SM(W_f , temp, sizethread), Kernel 1,

---

    fwt_kernel_SM(W_f , temp, sizethread)

shared tmpsdata; //declare share memory

tid ← thread // Set index of the thread

laneId ← thread + block // Set index of the grid

value ← W_f[laneId]; //Local variable for every thread, take from W_f

    for j = 1 to sizethread do

        tmpsdata[tid] = value;

        __syncthreads();

        if(i[n−j+1] = 0) then / ∗ if((i&j) == 0) ∗ /

            value ← (tmpsdata[tid] + tmpsdata[tid+j]);

        end then

        else

            value ← (−tmpsdata[tid] + tmpsdata[tid−j]);

        end else

        __syncthreads();

        temp[laneId] ← value;

        j ← 2 ∗ j

    end for

First kernel (**fwt_kernel_SM**) takes the following as input:

- array W_f where to put Polarity Truth Table PTT of the Boolean function f, with 2^n entries

- array temp with 2^n entries, initialized to 0

- variable size thread initialized to x ($0 \leqslant x \leqslant 1024$, x = 2^n , if($2^n > 1024$) ⇒ x = 1024), used for loop in kernel function

and return the array W_f with 2^n entries, complete Walsh spectrum W_f of the Boolean function f. This algorithm passes all elements of the matrix $S_{mat}^{(n)}$ in n steps column by column starting from the last one.

After start of the kernel, shared memory is declared, and data is written from W_f to shared memory. Every thread takes two elements from the shared memory makes addition or subtraction depending on the binary representation of the nonnegative integers smaller than 2^n, stores result in local variable and at the end of step threads are synchronized. If $2^n > 1024$ there is no risk of rewriting data, because computation is separated per block and there is no interaction between threads from different block during the first kernel.

After finishing the first kernel, second kernel begins and proceeds to next step until the last step (depending of PTT size, element). Second kernel is the same like the first one with the addition of memory pattern. Memory pattern is for rearrange the memory in such a way that memory elements from different blocks are set in order to perform FWT from first step. After a certain number of steps

again new rearrange is made to obtain proper arrange of the memory.

---

fwt_kernel_SM_MP(temp, W$_f$result, sizeblok)

---

fwt_kernel_SM_MP(temp, W$_f$result, sizeblok)

shared tmpsdata; //declare share memory

tid ← thread // Set index of the thread

laneId ← thread + block // Set index of the grid

/*Memory pattern*/

ji = (laneId − (laneId/sizeblok) ∗ sizeblok) ∗ 1024 + (laneId/sizeblok);

value ← temp[ji]; //Local variable for every thread, take from W$_f$

for j = 1 to sizethread do

  tmpsdata[tid] = value;

  __syncthreads();

   if(i[n−j+1] = 0) then / ∗ if((i&j) == 0) ∗ /

    value ← (tmpsdata[tid] + tmpsdata[tid + j]);

   end then

   else

    value ← (−tmpsdata[tid] + tmpsdata[tid − j]);

   end else

  __syncthreads();

  W$_f$result[ji] ← value;

  j ← 2 ∗ j

end for

Second kernel takes the following as input:

- array temp with 2^n entries, intermediate result from first kernel

- array W$_f$ result where to put final result of the Boolean function f

- variable sizeblok initialized to x ($0 \leqslant x \leqslant 1024$, x = 2^n/1024, if($2^n = 2^{20}$) ⇒ x = 1024), used in expression of memory pattern;

and return the array W$_f$ result with 2^n entries, complete Walsh spectrum W$_f$ of the Boolean function f. Expression which defines us memory pattern is the following one:

ji = (laneId − (laneId/sizeblok) ∗ sizeblok) ∗ 1024 + (laneId/sizeblok);

here *laneId* is the global index on the thread and *ji* index of array element in memory (memory pattern index).

At beginning of the kernel we declare shared memory and local variable and after declaration we copy *temp* result from the first kernel into local variable *value* of each thread and as an index we use *ji*. Value from the local variable we write in shared memory array, from where we continue with calculation of FWT. After the calculation, memory pattern is use again to return memory in the correct order and write the result back in W$_f$result global memory array. In figure 1 we show memory movement for Boolean function f, with 2048 entries. For Boolean function f, which have more than 2048 entries, is used the same memory pattern but movement of the data will be a little different in order to perform FWT from first step.

V. ALGORITHMS EVALUATION

We use the following computer configuration: Intel i3-3110M [10] with 2.4 GHz and 4 GB of RAM and NVIDIA GeForce GT 740M [11], cards with a total of 384 cores running at 0.9 GHz and a 28.8 GB/sec memory bandwidth. The algorithm is implemented in parallel computing platform and programming model CUDA [6]. We use CUDA Toolkit 7.0 and developed environment is MS Visual Studio 2010. Program is executed in Active solution configuration - Release, Active solution platform - Win32.

Speed up is defined by:

$$S_p = \frac{T_{(1,n)}}{T_{p(n)}}$$

where $T_{(1,n)}$ is the run-time of the fastest known sequential algorithm and $T_{p(n)}$ is the run-time of the parallel algorithm, and n is the size of the input.
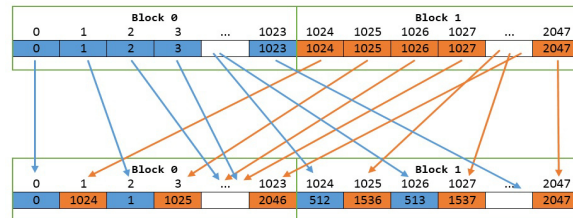
Figure 1.   Memory pattern for boolean function f, with 2048 entries

TABLE I.

TABLE I. CPU VS. PARALLEL ALGORITHMS, SPEED UP FOR DIFFRENT NUMBER OF ELEMENT

size	CPU (ms)	Algorithm 1 (ms)	Algorithm 2 (ms)	Alg. 1 vs Alg. 2	CPU vs Alg. 2
128	0,003	0,024	0,0066	/	/
256	0,007	0,026	0,0066	/	1.060
512	0,015	0,028	0,0069	/	2.272
1024	0,033	0,034	0,0071	/	4.647
2048	0,068	0,039	0,0124	2	5.483
4096	0,145	0,048	0,0147	3,02	9.863
8192	0,308	0,062	0,023	4,967	13.391
16384	0,665	0,096	0,052	6,927	12.788
32768	1,148	0,165	0,13	6,961	8.836
65536	3,116	0,366	0,28	8,513	11.128
131072	6,87	1,561	0,595	4,401	11.546
262144	14,81	3,571	1,207	4,149	12.276

Table I shows time execution for the CPU and GPU algorithms implementations of FWT for different number of elements and speed ups, which appear in the GPU implementation. CPU is faster for small problems and can work faster than couple of threads. For more elements, more threads are used and therefore the computation is faster than in the case of sequential programming. However, there are imitations which depend on several things (the problem, the algorithm, GPUs, the libraries, the model, etc.). Another interesting observation about the Algorithm 2 is intersection of time executions. In some points the memory pattern has higher price (spends more time on memory movement) than shared memory computations. This duplication is due to the memory pattern that is used for reordering the data.
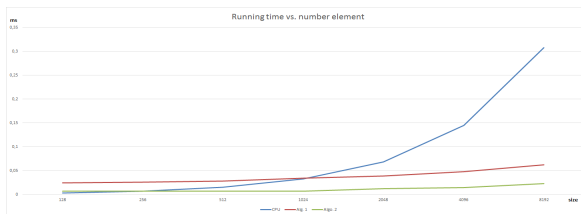
Figure 2. Time for calculating [W_f] CPU vs. Algorithm 1 and Algorithm 2

On Table II and figure 2, we can see the benefit from using the shared memory. Depend on the algorithm 2 design and size of element we obtain variable speed ups. This variation of speed ups also depends on the memory pattern that we use in second kernel, Algorithm 2.

TABLE II. ALGORITHM 1 VS. ALGORITHM 2, SPEED UP

size	128	512	2048	8192	32768	131072
Alg.1 (ms)	0,024	0,028	0,039	0,062	0,165	1,561
Alg.2 (ms)	0,0066	0.0069	0,0124	0,023	0.13	0.595
Speed up	3,63	4.05	3,14	2.69	1.26	2.62

VI. CONCLUSION

In this paper we proposed a performance model for computing Walsh transform with wide use NVIDIA GPU by using popular models in the parallel algorithm community. Here we presented the effect of considering a CPU versus GPU speed. We show how basic algorithm can be improved in order to obtain better performance. Wide used modern GPU has become attractive for scientific computing. This is one of the many examples and here we can see the benefits of using it. Note that here we use low class of GPU.

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Cable Distribution Systems - an Essential Element of the Global Information Society

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Abstract - Not long ago, before the advent of cable operators, here in Macedonia, especially in the smaller towns in this area in the developed countries was overwhelming. In Shtip were able to follow only two or three programs in the Macedonian Television. Later, in the nineties of the last century, there have been two more programs to private local television stations. Admission to these programs is done through external antennas. Nevertheless, due to the specific configuration of the terrain and tall buildings, it was not possible quality reception of TV programs in all parts of the city. On the other hand, this way of receiving television programs by external antennas (and several antennas for each family) and brings other problems. Among other things, in terms of aesthetic appearance of buildings resemble a "forest" of antennas.

With the advent of cable operators, this picture changes significantly. At the beginning of its development, the cable operators only offered a service to its customers - analog TV.

Today, cable operators offer more services, i.e. services, and are called Multi Service Operators (Multi service operator - MSO). They invest in quality and expensive equipment that receive and distribute to end users a number of TV and radio channels with high quality. Users however, relatively inexpensive monthly fee can enjoy the quality of TV channels, radio channels, internet, telephony and other interactive services. Today through KDS can carry more than 70 (seventy). Analog television and radio programs as well as a much larger number of digital TV and radio channels. Additionally through KDS enables fast digital communication, access to high-speed, broadband Internet and fixed telephony. Modern cable distribution systems represent a form of electronic communication networks. Electronic communications networks other than cable can be partially or completely wireless.

I. INTRODUCTION

Cable television began to be used back in 1948 in a small town in the state of Pennsylvania in the United States. The system then was called Community Antenna Television (CATV). Residents had a problem with reception of TV stations because the place on all sides was surrounded by hills. The signals from several antennas mounted on top of a hill near the town using coaxial cables are passed on to interested families. At the beginning of its development, cable distribution networks were built only with a coaxial cable. Somewhere around 1976 they began to use optical cables to transmit signals; initially in very small quantities and only in very long sections of the network. Furthermore, the development of technology, a growing percentage of the network is built with optical cables and additional optical elements such much better in terms of coaxial network. The advantage of optical technology is evident both in terms of attenuation of signals that are transmitted through the network, and in terms of interference caused by surrounding RF radiation.

Using optical cables enables transmission of signals with much higher quality compared to the wired network coaxial. Because optical cables have very little attenuation of signals, the transmission of signals possible much larger distances.

Signals from the main station using optical cables are transferred to certain locations - nodes (node). Between the main station and optical nodes, information is transmitted using a modulated laser beam through optical cables and further between nodes and end users, the information is transmitted using RF signals over conventional coaxial cables or coaxial network. An optical node is used to serve a number of users. This type of network is called a hybrid optical-coaxial network (Hybrid FiberCoaxial network or HFC network). In this configuration was first used in 1987. As you progress technology in future optical segment KDS will increasingly expand at the expense of the coaxial part of KDS until the final extrusion of the coaxial part of the network when the entire Cable Distribution Network from the main station to the

end users will be optic (FTTH - Fiber-To-The-Home).

II. CABLE DISTRIBUTION SYSTEMS

The term cable distribution systems (KDS) means transmission of signals from the main station to the multitude of end users via coaxial cable network. Popular name for this system in our country is a Cable Television in the US called CATV-Community Antenna Television. Nowadays most of the cable networks based on HFC technology (English: Hybrid Fiber Coaxial network – Hybrid Optical coaxial network) so the term will mean KDS-HFC network. There are several types of cable distribution systems (KDS), which in recent years become versatile. Through Cable Distribution Systems to customers transmitted more services i.e. services. For example, analogue and digital TV and radio channels, high speed broadband and telephony. Also introduced services such as "Pay to watch" (PPV-Pay per View) and "Video content on-demand" (VOD-Video on Demand). The possibility of choice of a growing number of television and radio programs as well as the possibility of rapid mutual digital communication carries with it the possibility of faster overall transmitters that broadcast programs are listed in various countries, citizens were forced to ask for several external antennas, amplifiers, switches and other devices in order to provide better reception.

Nevertheless, due to the specific the terrain and tall buildings, it was quality reception of TV programs in all parts of the city. On the other hand, this television programs by external several antennas for each family) and brings other problems. Among other things, in terms of aesthetic appearance of buildings resembling a "forest" of antennas. With the advent of cable operators, changes significantly. At the development, the cable operators service to its customers - analog TV. Today, cable operators offer more services, i.e. services, and are called Multi Service Operators (Multi service operator-SO). They invest expensive equipment that receive and distribute to end users a number of TV and radio channels channels with high quality. Users however, relatively inexpensive monthly fee can enjoy the quality of TV channels, radio channels, internet, telephony and other interactive services. Today through KDS can carry more than 70 (seventy!) Analog television and radio programs as well as a much larger number of digital TV and radio channels. Additionally through KDS enables fast digital communication, access to high-speed, broadband Internet and fixed telephony. Modern cable distribution systems represents a form of electronic communication networks. Electronic communications networks other than cable can be partially or completely wireless.

III. CONCEPTION CABLE DISTRIBUTION SYSTEM

Cable Distribution System can be broken into two parts: 1. The main station of the State Security Committee (external and internal part), 2. development of society. With its interactive capabilities, cable distribution systems today an essential element of the global information society. Not long ago, before the advent of cable operators, here in Macedonia, especially in the smaller towns in this area in the developed countries was overwhelming. In Stip were able to follow only two or three programs in the Macedonian Television. Later, in the nineties of the last century, there have been two more programs to private local television stations. Admission to these programs is done through external antennas. Since antennas via Distribution network of KDS.

A. *Home station of KDS - inner part*

For transmitting signals from analog TV programs, digital TV programs and other information via Cable distribution network first, this information shall be affixed (modulate) the electromagnetic radio waves (RF=Radio Frequency) which are used as "carriers" of useful information. Inside the main station on KDS used devices to process signals received from the antenna reception system as well as production of internal audio-video information), then their conversion, switching, (possibly reinforcement) and associating in a complex frequency multiplex signal. Before putting into the distribution network of KDS. There are multiple ways of processing the signals received from the antenna system.

B. *Professional main station on KDS for many users*

In large systems that have tens of thousands of users in one or more cities with a shared main station, it is absolutely understandable use of a system of the highest possible quality. In professional high quality main station first, signals from the antenna reception system using tuners (tuners) or set-receivers (receivers) are demodulated to receive audio and video signals from TV programs that we want to convey. Audio-video signals, if necessary, can be held in the devices which control the intensity and color tone of the audio signal, or the contrast, brightness and color of the image.

This way of processing to change TV standard (for example, the SECAM PAL) of the desired channel before being put in the network. In addition, it is possible to use the decoders for encrypted programs. Also, the audio-video signals, it is

possible inserting various audio or video image information in any channel which is transmitted through the system. Except for commercial use, this is especially important in terms of quick information on various possible dangers or the like, when is invaluable rapid notification to customers and react.

Further audio-video signals are kept in modulators where they modulate the carrier RF signal with a frequency in the frequency range from 33.15 to 41.15 MHz (RF carrier tone: 33.4 MHz and RF carrier image: 38.9 MHz) which is called inter frequency. At this level filtering is performed using a special piezoelectric crystal filters called "SAW" filters using that receives the signal with a lateral belt, while the other lateral strip is suppressed (Vestigial side band). This is in order not to disturb the adjacent channel after the signal is converted to one of the channels in the frequency range 112-860 MHz. Also between ends frequency signal applied automatic gain control and get clean between frequency carrier signals at a constant size regardless of the size of the signal in the antenna. Furthermore, this between frequency signal is converted into one of the channels in the frequency range 112-860 MHz. Finally, the modulated RF signals from all channels are merged into a single multiplexed RF signal is amplified, and plays in the network of Cable Distribution System.

Modern cable systems except Distribution transfer TV programs and allow the transmission of Internet, telephony and other interactive services to its users. Transmission on the Internet, the main station connection is established to the global Internet network through at least two solid interconnecting lines of at least two Internet providers. This is done so users do not remain without internet in case you break one link to the Internet provider. The flow of traffic on the Internet providers to Cable Distribution System goes through powerful edge router (edge router), for example "Cisco edge router 7609"
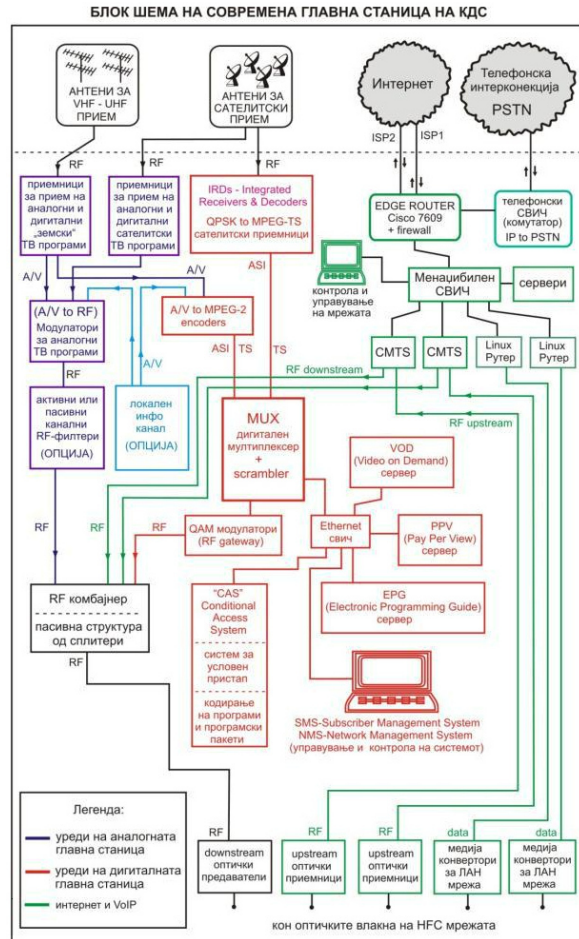
Figure 1. Scheme of Modern Cable Distribution System

Overall Internet traffic through Cable Distribution System is managed through a major "core router" (English: core router) and many others too powerful routers and switches managed (switches). Here are just a few of the functions performed by these routers together with the management switches: Provide connectivity to the global Internet network providers via the Internet; Distribute Internet traffic and caring for smooth load on the network;

Determining the connection speed for each of the users; Prioritize different types of Internet traffic; Filtering of Internet traffic; Monitoring of Internet traffic; VLAN settings; Provide backup onto the network etc. "Backup route".

Other electronic devices as an integral part of the main station in the area of Internet traffic: DHCP server (necessary in all networks); Mail server (optional); FTP server (optional); Web server (optional); Server network multiplayer "game server" (optional).

For users who use the internet through docsis technology (distribution of the Internet via coaxial cable and cable modem for users) to the main station and sub-stations are installed and CMTS (Cable Modem Termination System) devices and receiver signal from the return path (upstream), which explained later in this book (under docsis-internet).

Fixed telephony Cable Distribution System is transmitted via Internet in the form of special VoIP packages. This technology is known as "IP-Telephony" or "VoIP" (VoIP = Voice over IP). In the main station of the Cable Distribution System is required to install a device called a telephone switch "IP-to-PSTN" (Public-Switched Telephone Network). This device converts and route IP-based calls through traditional phone signals classic phone system. Among other things, switch phone records and charged all phone calls generated by the users in order then appropriate to charge through monthly bills.

IV. CONCLUSION

One of the basic conditions for the smooth operation of Cable Distribution System is a quality power supply system with electricity. If the power failure in the main station, all users connected to the system will be affected. Therefore, it is necessary to use the system for uninterrupted power supply (UPS-Uninterruptible Power Supply). There are various types of devices for uninterruptible power supply. Common to all is that use accumulators at a time of electricity is automatically recharged and are complementing. In case of power failure,

uninterruptible power system, energy-filled draws from the batteries without any power interruption.

It is necessary to properly sized UPS-system depending on the strength of the devices in the main station or the power consumption of these devices. However, batteries can provide electricity for the operation of the main station only a short (limited) time. For longer power outages from the city network, it is the purchase of a generator of electricity. Generator commonly used diesel fuel for its work. Power generator should be slightly higher than the power of devices that are connected to work through it.

During a power failure, power generation automatically. In the time between power failure and the inclusion of the generator, the main station devices are powered by batteries of the UPS-system. On such a way is provided continuously, main power station with the power required. When working with components and devices that use electricity should be given necessary attention. Some devices use high voltage which can be lethal if not handled properly.

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The IoT in Education

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Abstract - The Internet of Things (IoT) is a quiet new emerging technology which will be used to connect all objects through the Internet for remote sensing and control. IoT uses a combination of WSN (Wireless Sensor Network), M2M (Machine to Machine), robotics, wireless networking, Internet technologies and Smart Devices. Connected devices are already present in the classroom, but the IoT will boost new levels of connectivity and learning approaches, particularly in the areas of science, technology, engineering, and mathematics (STEM). Especially virtual laboratories represent important scenario for improving teaching with the applying IoT systems. Overall possibilities of virtual reality for enhancing teaching and learning are numerous and in constant development, but safety aspects of those systems are very important.

I. INTRODUCTION

By the year 2020, it is predicted that more than 50 billion connected devices will be on the Internet. Internet of Things, a term coined in 1999. by Kevin Ashton, is a network of physical objects that are connected to the Internet. These objects such as sensors, smartphones, watches and electronics will transmit data via Internet to the cloud providing a "smarter" service or experience for the user. The Internet of Things (IoT) will soon be called the Internet of Everything (IoE).

For consumers, the IoT has the potential to deliver solutions that dramatically improve energy efficiency, security, health, education etc. Technologies will always have a huge place in education. The IoT refers to the use of intelligently connected devices and systems to leverage data gathered by embedded sensors and actuators in machines and other physical objects (Figure 1).

There is tremendous value in connecting the unconnected with intelligent networks across education. However, to realize the benefits from connecting people, processes, data, and things, reliable connectivity and continuous access must be guaranteed. Additionally in order to accept IoT, both policymakers and educators must be well-prepared not only to exploit, but also to understand potential risk and disadvantages.

Machine to Machine (M2M) solutions/a subset of the IoT already use wireless networks to connect devices to each other and the Internet, with minimal direct human intervention, to deliver services that meet the needs of a wide range of industries.

Figure 1. Internet of Things

The use of IoT in education is expected to increase dramatically due to the growth of online and blended educational programs, as well as in traditional classrooms that increasingly use technology as a teaching tool [5].

II. IOT IN THE CLASSROOM

Nowadays more than ever before digital innovation in education is a primary target for schools and organizations in all over the world. Educators are now acknowledging digital literacy as a common standard, alongside more traditional measures of competency and growth. The world outside of schools is becoming increasingly connected and classrooms are likewise evolving from isolated learning environments into global collaborative learning centers.

College students want a highly personalized, engaging educational experience with increased virtual learning opportunities and more flexibility in classroom models. To meet these demands, colleges and universities can bring the IoT into their

classrooms to help connect the hardware and software that faculty staff/students use every day. An IoT-enabled classroom can take advantage of a colleges existing technology investment to help adequate automate and simplify classroom tasks, improving both online and face-to-face learning.

There are four areas which should be addressed for the IoT in the classroom:

- *Open source computing projects*

  This includes miniature single-board computers that run on open source operating systems and support communication via WiFi, Bluetooth, RFID, and other low-power connections. Miniaturized single-board computers (Raspberry Pi, Arduino) are inexpensive and designed for experimentation purposes.

- *Communication protocols*

  Students experimenting with IoT should learn about the major connectivity methods being used with IoT devices. These include the widely known WiFi and Bluetooth, as well as others like Zigbee, NFC, RFID.

- *Sensors*

  IoT devices increasingly include multiple sensors that monitor environmental conditions like sound, temperature, light, and movement. Students should learn what sensors are available and how they can be programmed to trigger events and notifications. These actions are the reasons many IoT devices exist and are the basis for the intelligence that can be derived from the devices.

- *Messages*

  The creation and transmission of messages triggered by sensors delivers information across the networks where IoT devices connect. The frequency and format of IoT messages are important because of the information that needs to be transmitted, but as network traffic becomes increasingly crowded, efficiency and size are more important than ever [1].

IoT needs to become part of the curriculum from grade school through high school. Students experience with products and services leveraging the IoT will prepare them for handling IoT-related tasks by using the skills and products they have learned in schools (Figure 2).
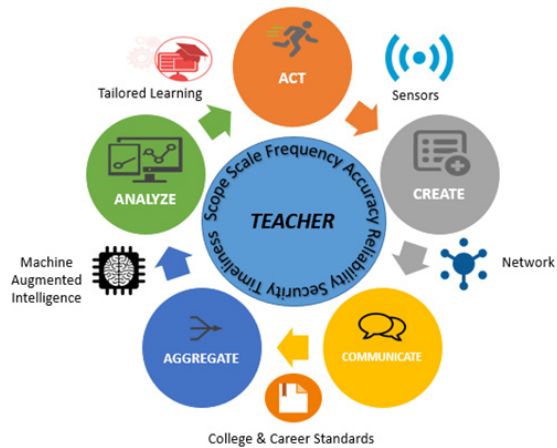
Figure 2. Internet of Things Enabled Teaching

IoT has the ability to improve upon the learning experience by allowing for real-time and actionable insights into student performance. Students bring wireless devices into the classroom or use them at home. The materials available for learning on mobile devices, such as e-books, are more engaging and interactive. There is a constant need for new technologies for education, such as high-speed wireless networks with the bandwidth for streaming audio and video lessons.

The advanced eLearning applications allow students to work at their own pace through a course, which increases both satisfaction and course completion rates. Teachers can provide one-to-one instruction and seamless student assessments. Through cloud technology, instructors can collect data on student performance. The advanced technology used in education also allows teachers to share and collaborate with one another [5].

Concept "Bring your own device" (BYOD) refers to technology models where students bring a personally owned device to school for the purpose of learning. Due to the ubiquity of wireless internet enabled personal devices, the reality is that web based tools and resources have changed learning, because students have at their fingertips unlimited access to digital content, resources, experts, databases etc [6].

A. *Iot-connected classroom*

IoT can provide benefits to almost any economic sector and in education also. IoT technology is strenghtening education to bring about an age of digital learning, updating campuses and classrooms for the better.

Over the years, it was generations of new classroom technology to transform learning, TVs, computers, the Internet, whiteboards/smart boards, educational

games, video conferencing, student response systems (Figure 3). In every case can be identify examples where the technology was deployed and yielded successful results.

Figure 3. The IoT in the Classroom

IoT leverages advances in electronics, enabling the development of smaller, reduced power, and most importantly less expensive wireless systems that can be integrated in almost any type of device. Although Wi-Fi is the most recognized form of wireless technology, IoT leverages other connectivity technologies including Zigbee, NFC, RFID and Bluetooth.

Some of these technologies require so little power, that they can last for years (watch battery), while some other (like RFID) can even be passive, requiring no power source at all. Bottom line is the technology exists to add wireless sensor capabilities to virtually any device, including wearables, books, small sensors, fixed structures and even people [2].

B. Smart internet of things devices for schools

IoT generally refers to machine-to-machine (M2M) communications involving network-based remote sensors and actuators. Wireless sensors generate data (so-called Big Data) which can be stored and analyzed either on site, or in the cloud.
The range of smart devices found in schools today includes: eBooks and tablets; sensors in the hallways, entrances, classroom spaces; virtual and augmented reality headsets; robots; video sensors; smart displays; smart lights [3].

Data from these devices can be used for simple tracking, as with student attendance, school buses and supplies, or more complex monitoring, for example, to understand student learning patterns as they progress through their eBooks and adaptive learning systems. All activities can be monitored in real time during critical periods of online testing. Throughout the school building, low-cost sensors

enable a more finely-tuned HVAC (heating, ventilating, and air conditioning) system to keep the environment optimally tuned and to reduce expenses [3].

Wi-Fi network in schools must be scalable to handle the rapidly-growing number of smart devices coming onboard. Addressing the security, safety and privacy concerns inherent in primary/secondary schools and higher education unavoidably requires comprehensive network management software.

Incorporating the IoT into the curriculum by introducing devices, like Arduino and Raspberry Pi, helps teach engineering and math, but even more importantly inspires indispensable creativity.

The vast arrays of big data provides students with the opportunity to learn data analysis and to gain insight into the growing career opportunities in data science (Figure 4).
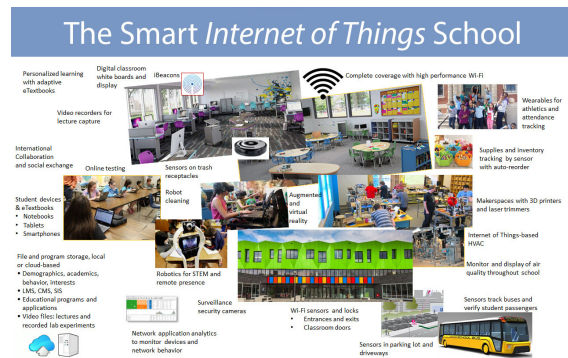
Figure 4. Smart IoT School

The growing streams of school and student-related data create the opportunity and the challenge to provide a more personalized student learning experience, while controlling costs. Learning from the patterns of highly successful students could benefit the entire student body. In a farther-out scenario, both in time and in weirdness, not only is student attendance tracked, but also their in-class attention [3].

New IoT technologies increase student engagement and provide a safer learning environment. Teaching can take place in an entirely mobile, highly-responsive environment. This helps insure that all students are prepared for college and careers, including careers that probably may not exist today.

III. FACTORS FOR SUCCESSFUL IMPLEMENTATION OF INTERNET OF THINGS IN EDUCATION

The Internet of Things would allow for better operational efficiency in almost every type of learning environment. Connected devices could enable educators to perform dynamic classroom interventions.

Classroom discipline would be much more easily enforced with vibrations that are similar to a silent notification on a mobile phone. These devices could redirect a student's attention, such as giving a warm-up exercise to do on their device. During examinations, a students identity could be verified through their brain waves tracked by a wearable [5].

The IoT surely has a huge potential in education. However three key factors must be addressed to ensure widespread and successful adoption. They are: security, data integrity and education policies.

C. Security

IoT security will become an enormous issue across all markets - particularly in education. Without assurances, pervasive development of IoT will not take place across educational institutions. Information must be available, yet confidential when needed, with the owner of the information deciding which people, groups, or organizations may have access to it.

Embedded devices will lead to complex networks of people/things in both the public and private sectors. Those devices will likely create new relationships among people and computers in the future.

Balance must exist between understanding the positive impacts and generating awareness about the risks to privacy and security. Both educators and learners will need to have a better understanding of ethical issues and the risks of IoT, as well as modes to mitigate those risks [4].

D. Data integrity

Integrity of data must also be assured, as its accuracy, authenticity, timelines and completeness. Success will be predicated on an so-called "open platform" that allows all partners working together to use the same baseline technologies. Educators will need to work closely with government to ensure the development of IoT in education [4].

E. Education policies

Policies that encourage adoption of technology in the classroom and its effective integration into curriculum are crucial. Such policies must include sound change management practices among educational institutions to reduce the barriers to technology adoption and increase its scale. Professional development programs for educators should incorporate IoE tools to encourage early adoption and help educators to develop innovative methodologies and appropriate pedagogies for the learning environment [4].

IV. CONCLUSIONS

The IoT, as a new sophisticated state-of-the-art technology, has a large potential in education processes. This system has a different capabilities that can be used in teaching at all levels. Especially IoT can simplify and automate access to necessary information, which saves teachers and students time, then effort and resources. Besides of that it is ultimately to have appropriate educators who need be able to identify the right technologies and integrate them properly in the classroom for the advancement in education overall.

There are various qualitative smart IoT devices that can be used in teaching by using various forms and methods in classrooms. In the field of STEM education virtual laboratories by using of IoT systems are of great benefit. The IoT supported learning in education is convenient, flexible, cost effective and as a such has potential to make education more innovative and adaptible.

The most important factors for appropriate implementation of IoT in education are: security, data integrity and education policies. All of these factors must be considered in synergy and particularities. With different devices interconnected, a greater amount of security is required for sensors and systems, with the need to manage and analyze big data reports from these sensors.

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GAMES AND SIMULATIONS

IN EDUCATION

Simulation of M/M/n/m Queuing System

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Abstract - Simulation is the imitation of the operations of a system or process from the real world, which takes place over time. Simulation involves generating artificial history of the system and observation of the same, for making important conclusions about the operational characteristics of the presented system. In this paper we analyze the queuing system with finite capacity M / M / n / m. Additionally, we give demonstration of simulation of the market as example of M / M / n / m queuing system.

I.   INTRODUCTION

The simulation model represents a set of assumptions concerning the operations of the system. These assumptions are expressed in mathematical, logical, and symbolic relationships between the entities, or objects of interest at the system. Once developed and validated, the model can be used for answering at "what if?" questions about the real-world system. Potential changes to the system can first be simulated, in order to predict their impact on system performance. Simulation can also be used to study systems in the design stage, before such systems are built. Therefore, simulation modeling can be used as an analysis tool for predicting the effect of changes to existing systems and as a design tool to predict the performance of new systems under a variety of different circumstances. Simulation models have their advantages and disadvantages that make it impossible to receive a   clear answer at the question when to use simulation. Technically correct response is that the simulation should be used when the advantages of its use outweigh the disadvantages. Practically speaking, the simulation analysis should be selected when one or both of the following conditions are satisfied: the necessary assumptions required for suitable analytical model are not efficiently fulfilled from real system or appropriately formulated model can't be solved analytically. [1]

Some of the advantages of simulation are presented below:

- Simulation permits to test every aspect of the proposed change or data, without these to be realized. This is important because if it's

made a decision, make some changes, install some new system, all without being tested, it is possible to occur some problems later and the changes and corrections can be quite expensive.

- Avoid Reducing and increasing time. By reducing or increasing of time, the simulation allows acceleration or deceleration of time, the simulation is enable to accelerate and decelerate of the phenomenon, for analyze it more studiously.

- Often, the Managers want to know why a phenomenon appears in real systems. Simulation find answers at this question, so, execute the reconstruction of the scene are developed microscopic examinations of the system to determine why the phenomenon appear. This can't be achieved in real system because it can't be controlled and seen completely.

- One of the biggest advantages of using simulation software is that once it develops a valid simulation model, can be studied new operational procedures or methods without experimenting with real system. Modifications are included or entered into the model, and observe the impact of these changes on the computer instead of the real system.

- Modern factories and organizations are quite complex, so it's impossible to be known all interactions which exist at a given moment. The simulations are enabling better understand of the interactions between the variables that constitute such complex systems.

Except the advantages, of course, some disadvantages of simulation models exist:

- Model building requires special training. It is an art that is learned over time and through experience. Furthermore, if two models are constructed by different individuals, they

might have similarities, but almost certainly will not be the same.

- Simulation results can be difficult to interpret.

- Simulation modeling and analysis can be time consuming and expensive.

- Simulation is used in some inappropriate cases when an analytical solution is possible, or even preferable.

Process simulation systems include the following steps:

1. Problem formulation ;
2. Data collection and analysis ;
3. Developing of the model ;
4. Verification and checking the validity of the model ;
5. Experimenting with the model and optimizing ;
6. Implementation of the results of the simulation.

To model a system, it is necessary to understand the concept of a system and the system boundary. A system is defined as a group of objects that are joined together in some regular interaction or interdependence towards the accomplishment of some purpose. A system is often affected by changes occurring outside the system. About this kind of changes we are saying that occur the system environment. In modeling systems, it is necessary to decide on the boundary between system and its environment. This decision may depend on the purpose of the study. In the case of the factory system, for example, the factors controlling the arrival of orders may be considered to be outside the influence of the factory and therefore part of the environment. However, if the effect of supply on demand is to be considered, there will be a relationship between factory output and arrival orders, and this relationship must be considered an activity of the system.

II. QUEUEING SYSTEMS

Simulation is used often in the analysis of queueing system also known as congestive systems. These are systems which have need of system resources, and when resources are not available, those who are looking for, will wait to be available. Examples of these kinds of systems include clients who requires bank teller services, customers who pays on supermarket, in the computer system processes that are waiting on a central processing unit, etc.

Although, discrete simulation models are commonly used to analyze congestive systems, the uncomplicated or simplified analytical models of congestive systems can be helpful in explaining the more complex congestive systems. In addition to this, knowledge of congestive analytical models is often useful in the design and validation of simulation models and statistical analysis of the output of the simulation congestive systems.

Key elements of the queueing systems are the clients and the servers. The notion "client" can refer to people, machines, automobiles, patients, airplanes - everything what requires a specific service from a resource. The notion "server" can refer to a receptionist, a workman, a mechanic, medical staff, the processor (CPU) of a computer - any resource (people, machines, etc.) which achieve the required service.

The Kendall classification of queuing systems exists in several modifications. The most used classification uses 6 symbols:

$$A/B/s/q/c/p$$

These symbols represent the following characteristics of the system:

A - the distribution of the length of the intervals between two successive arrivals.

B - distribution of service time.

s - is the number of servers.

q - is the queuing discipline (FIFO, LIFO,…)

c - is the system capacity.

p - is the population size (number of possible customers).

A and B can be used for following markings:

M – Poisson input flow i.e. arrivals (the length of the intervals between two successive arrivals follows an exponential distribution)

E_m^r – is the Erlang distribution.

D – is the symbol for deterministic arrivals and constant service time?

G – is a general distribution.

GI – is a general distribution with independent random variable.

III.   *M/M/N/M* SYSTEMS

M/M/n/m system is queueing system where arrival distribution of client follows Poisson distribution (arrival rateλ), distribution of service time follows Exponential distribution. The system is composed of *n* servers (service rateμ) and limited FIFO queue (*m-n* places in the queue). If a new client comes when the system is full (we have *m* clients in the system), that client does not enter in the system, is leaving.

This system, for any values of λ and μ for which $\rho = \dfrac{\lambda}{\mu} \neq 1$ may be observed in a stationary regime of work:

$$t \rightarrow \infty, \ p'_k(t) = 0,$$
$$p_k(t) = p_k. \qquad (1)$$

Effective arrival rate λ_e, the average number of clients per time that actually join the system is $\lambda_e = \lambda(1 - p_m)$, where $1 - p_m$ represent the probability that the client, on arriving, will find empty place and he shall enter into the system. For all systems is valid $\lambda_e \leq \lambda$, for the systems with unlimited capacity its used $\lambda_e = \lambda$ and for the systems which rejects or refuses clients because is filled its used $\lambda_e < \lambda$.

For this system we apply following formulas:

The probability that there are no clients in the system:

$$p_0 = \left[\sum_{k=0}^{n} \frac{\rho^k}{k!} + \frac{\rho^{n+1}}{n!} \frac{1 - \left(\frac{\rho}{n}\right)^{m-n}}{n - \rho} \right]^{-1}. \qquad (2)$$

and when $\rho/n = 1$: $p_0 = \left[\sum_{k=0}^{n} \frac{\rho^k}{k!} + \frac{\rho^n}{n!}(m - n) \right]^{-1}$.

The probability that there are *k* clients in the system has *k:*

$$p_k = \begin{cases} \dfrac{\rho^k}{k!} p_0, 1 \leq k \leq n \\ \dfrac{\rho^k}{n^{k-n} n!} p_0, n < k < m \end{cases} \qquad (3)$$

The probability that the client will wait in the queue is:

$$P(k \geq n) = \sum_{k=n}^{m} p_k = p_n \frac{1 - \left(\frac{\rho}{n}\right)^{m-n+1}}{1 - \left(\frac{\rho}{n}\right)}. \qquad (4)$$

The probability that client that comes into the system is not being served i.e. get cancellation:

$$p_m = \frac{\rho^m}{n^{m-n} n!} p_0. \qquad (5)$$

The probability that the client will be served is:

$$p_{ops} = 1 - p_m. \qquad (6)$$

Average number of clients in queue:

$$L_q = p_n \frac{\left(\frac{\rho}{n}\right)}{\left(1 - \frac{\rho}{n}\right)^2} \left[1 - (m - n + 1)\left(\frac{\rho}{n}\right)^{m-n} + (m - n)\left(\frac{\rho}{n}\right)^{m-n+1} \right],$$

especially, for $\rho/n = 1$ than we have

$$L_q = p_n \frac{(m - n + 1)(m - n)}{2}. \qquad (7)$$

Average waiting time of clients, in the queue is:

$$W_q = \frac{L_q}{\lambda_e}. \qquad (8)$$

Average waiting time of clients, in the queue is:

$$W = W_q + \frac{1}{\mu}. \qquad (9)$$

Average number of clients in the system is:

$$L = \lambda_e W. \qquad (10)$$

IV. EXAMPLE OF SIMULATION OF STORE

Within the project are included: simulation of a store with one cash register, simulation of a store with two cash registers and simulation of a store with three cash registers. In this paper we will review only the case of simulation of a store with one cash register. In the segment or section of input parameters (Fig 1.) are entered the input data for the calculation of the basics features of the observed system. Arrival rate represent the number of clients who arrive in one hour. Average service time is the mean time needed to service a client (reciprocal value of the parameter μ).

Figure 1 Input parameters

Maximum number of customers waiting in the queue with the number of cash registers (in this case only one) it gives the capacity of the store, respectively the maximum number of clients that can be in the store at given moment. If a client arrives at a moment when the store is full, then he would not enter in the store, i.e. get cancellation. When all these data will be entered, the simulation can begin by press the button "start". The clients are starting to come. If the cash register is free begins the payment, otherwise they stand in a queue and waiting. The visualization of store is given in Fig 2.
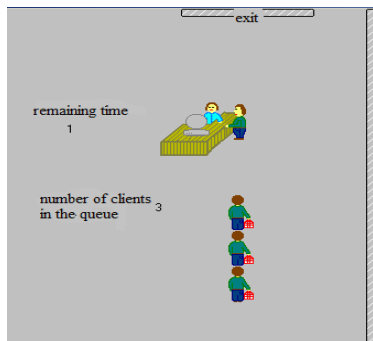

Figure 2 Visualization of the store

At that moment are beginning to generate and the output parameters Fig 3.

Figure 3 Output parameters

On this page we have few buttons in the upper right corner, Fig 4.
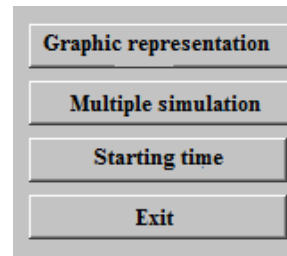
Figure 4 Menu

Each of these buttons has its function, to show you what it gets with selection the button "Graphic representation". In Fig 5. are provided tabular and graphic representation of obtained results, respectively the client's medium waiting time in queue and the medium staying time in the store. These results are updated every 10 minutes from the current simulation.

To answer the questions about the behavior and properties of the system, using the output of the simulation model, represent a rather difficult task. The output of the simulation model can easily to be misinterpreted so we get a wrong vision or idea about the system which is represented.

To illustrate this we would take a system with one server, or we will consider the store with one cash register. Let's suppose that customers come with arrival rate of 15 customers per hour and that the average serving time is 3 minutes, Fig 6.

The maximum number of clients is 20, which means that the length of the queue is 19. Also, we assume that the time between two successive arrivals of customers and the service time is exponentially distributed.

From the elementary queueing theory we can demonstrate that the average number of customers

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Figure 5 Graphic representation

who are waiting is L_q = 2,182 and the expected waiting time, of the clients, waiting in line is W_q =8,735 minutes. Using the simulation model, we determine the average number of customers waiting in queue and mean waiting time of the customers.

Figure 6 Input parameters

The results of 5 simulations with duration of 24 hours are shown in Fig 7.
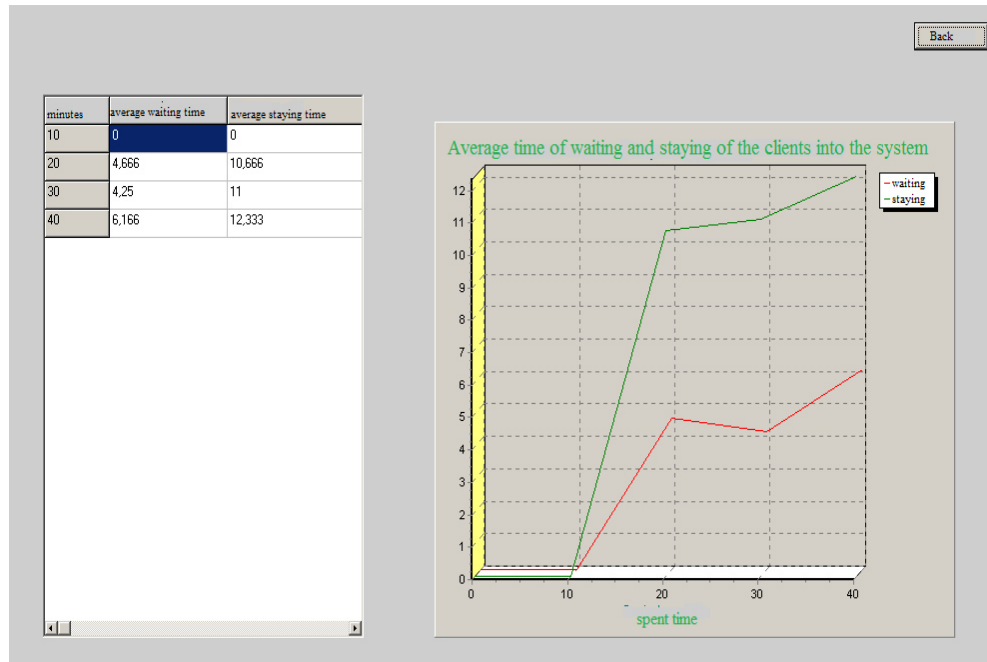
	Number of clients	Average number of customers waiting	Average waiting time
1	306	2,494	11,725
2	291	1,522	7,439
3	318	1,377	6,283
4	307	1,359	6,107
5	312	1,126	5,403

Figure 7 Results for 5 simulations with duration of 24 hours

If we calculate the arithmetic mean from the results of the simulations, we will conclude that the average number of clients who are waiting is 1,575 and the average waiting time of the clients in the queue is 7,391 minutes.

These simulations show the difficulty in making decisions regarding the behavior of such a system. Each simulation is equivalent to observing the system 24 hours a day. In each simulation time of waiting, of approximately 300 customers, is registered and calculated arithmetic mean. Although, we have large samples, in the evaluation of the average waiting time of customers in the queue, in each simulation we make some mistake. If we accepted the result of the first simulation, we would have had an unsure estimation of the average waiting time of the customers. From here we may conclude that it is not enough to perform i.e. to make only one simulation, it is necessary to repeat its, to get a clearer image of the simulate system.

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Development of Interactive Educational Applications Based on TouchDevelop

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Abstract – Recently, we are witnesses of major technological changes: the powerful, user-friendly mobile devices, such as smartphones and tablets, became more prevalent than desktop computers and laptops. In this paper we will use this new reality to focus on use of mobile devices in an educational process. In particular, we will explain the development of interactive mobile applications directly on mobile devices using TouchDevelop. It is a cloud-based integrated environment for developing, testing and running programs. The programs are coded in the TouchDevelop scripting language. The main goal is to make students active participants in application design, instead of being just passive users. At the same time, this will encourage them to continue to actively participate in programming process, using different devices.

I   INTRODUCTION

Mobile technology has become an integral part of our lives. Mobile devices and applications are changing the way we do things and how we connect with other people. Equipped with various sensors, mobile devices became a powerful tool for everyday activities. Children are also accustomed to the daily use of these devices. Mobile devices are changing the way today's children learn.

Analyses have shown that the use of mobile educational applications improves the learning experience, provides an effective and motivational learning environment where students can acquire skills and competences and promote critical thinking [1, 2, 3]. New style of learning requires new ways of teaching. There is a necessity to increase the teacher's trust as well as to promote the active use of technology in education process [4, 5].

Mobile technology promote diverse learning experiences that support students in "consuming" information (e.g., reading, searching, observing) as well as "creating" information (e.g. Storytelling, educational applications). From passive consumers, students became active participant in the process of creating applications. TouchDevelop environment, developed by Microsoft Research, can help students to accomplish this goal. It is an interactive development environment used to develop mobile applications using mobile devices (smart phones, tablets or laptops). The development environment also includes a facility for testing and debugging the program's user interface.

The abundance of literature speaking about TouchDevelop, as well as the support offered by Microsoft, can encourage students to take active part in the programming process [6, 7].

This paper presents some of the opportunities that TouchDevelop offers, through the creation of interactive educational applications that can be used during the classroom teaching process and in extracurricular activities.

II   TOUCHDEVELOP DEVELOPMENT ENVIRONMENT

TouchDevelop is a cloud–based integrated development environment that connects three types of users:

- Designers of a Touch Develop Environment

- Authors/creators of applications that use Touch Development Environment

- End users, who can use the applications, and at the same time can change and improve the functionality of the created applications [8, 9].
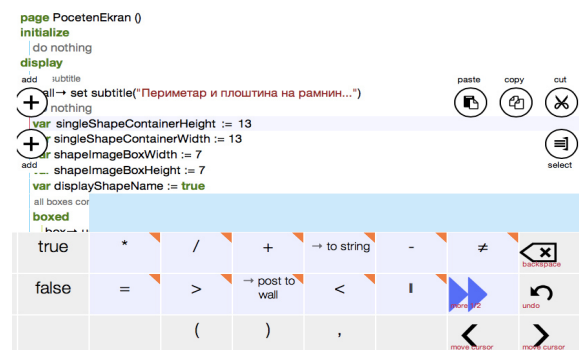

Fig.1. TouchDevelop Development Environment

Actually, TouchDevelop is a structured programming language, built for mobile devices that use touch-sensitive screen as the main input device

for writing the code [10]. Instead of the traditional text editor, TouchDevelop uses a semi-structured code editor that allows building of objects or tables. The reason of using this editor is not to eliminate syntax errors, but to facilitate the navigation between the syntax elements, which can be accomplished easily with a touch of a button of the user interface screen (Fig. 1).

The eco-system architecture of TouchDevelop allows users to retrieve and store all information, scripts or other data, in the touchdevelop.com cloud service, no matter if they are using their phone or computer's web browser. The cloud infrastructure enables sharing and acts as a repository of all scripts developed and published by users. This characteristic of a TouchDevelop actually provides a social experience for its users [8].

III USING TOUCHDEVELOP IN THE EDUCATIONAL PROCESS

A. Suitable for beginners

Programming environments used for learning programming skills in primary schools are usually based on the principle of building blocks, which is easy and funny way for students to learn the basic principles of programming, without actually dealing with the correct syntax of the professional programming languages. TouchDevelop allows that kind of learning.

B. Simple code sharing

Each developed application has a unique code, consist of four or more letters. Every student can easily create and publish his own application, so the other users can access, install or modify the application, according to their needs, by simply entering the code. The students can also rate the application and share their opinion with other students.

C. Classroom management

For an easier TouchDevelop class management, there is an option of making user groups – groups of students that can work on the same script simultaneously. The benefit of having a user group is the shared space that can be used for leaving messages and comments as well as a collaborative real-time script editing. The group is composed of group creator and the users who joined the group. Comments, visible only from the members of the group, are used to improve created script.

IV THE USE OF EDUCATIONAL APPLICATIONS AND GAMES IN SCHOOL CURRICULUM

In classroom, composed of a different student structure, the teacher has to find a way to realize the curriculum which is very extensive. Because of this,

instead of adapting the materials to the students, the students are forced to adapt to the learning materials. Furthermore, the rapid technological development affected the way students learn. There are huge informal learning possibilities that the new technologies enable. But, to exploit this opportunities, teaching strategies and curriculum need to be adapted within the regular classroom [11]. Interactive educational applications and games can be an excellent addition tool, only if they are adapted to the learning materials and environment. On the other hand, their incorporation in the extracurricular activities is considered to be unique due to the fact that it provides a degree of working freedom in various environments, a freedom of goal adaptation and a solution to some problem-solving tasks.

A. Creating interactive tutorials and online lectures using TouchDevelop

Interactive tutorials are step by step manuals build-up of codes and comments, where one step corresponds to a single action (Fig.2). Tutorials can help students to learn quickly and easily about the process of writing scripts and algorithms which are important part for the programming course. Depending on the correctness of the written command, students can continue to the next step until they finally reach program execution.

With lectures created using the TouchDevelop environment, teacher has the possibility to express in his mother language. Every lecture can contain exercises for evaluating the student progress. The students can complete these exercises individually. In this way the learning material will become more accessible for students who want to study independently.

Fig.2. Interactive script-making tutorial

B. Educational application for learning shapes

Educational application called "2D shapes" is created using the TouchDevelop environment (Fig.3). It is designed for sixth-grade students studying mathematics according to the Cambridge Program. During the school year students learn about different forms and shapes gradually. The developed application uses a combination of all

curriculum materials with the added option for student examination. By pressing the touch screen buttons the students can choose their desired geometrical shape, and to learn all the elements in this group through drawings and definitions. At the end, they have the opportunity to solve the exercises related to the corresponding shape. For every correct answer a positive comment appears and the student receives one point. If the student has problems solving the exercises, he can always return to the theoretical part to get some help, and to learn better the material.

Fig.3. Application for learning and practicing 2D-forms

The content of the application is organised in the way that gives users a comprehensive insight into the categories, similarities and differences of the shapes, and also provides formulas and formula derivations for all 2D shapes. The most important characteristic of this application is the fact that it is a free application and it is available for all students who want to review or learn the selected material, and want to make a self-evaluation using the exercises.

C. Games adapted to Computer Science course

Games that we created using TouchDevelop and which were included in our research were fairly simple, but they were adapted to the material from Computer Science course, which is often difficult to understand by students, due to the limited time of the classes.

Several games were developed, but in this paper we will present only two. The goal of the first game was to find dots in a rectangular coordinate system following assigned coordinates. In order to receive points, students should give an answer very quickly. For every mistake that he makes, he loses lives. The game ends when student lost all his lives (max. number of lives are 3), or when he reach the maximum number of points.

The second game was to learn the decimal-to-binary conversion. The idea came from the fact that

the sixth-grade students have difficulties to understand that the computer works only with two numbers, one and zero. This problem seems to be too abstract for the students. Because of this we have created a game, to help the students to learn the specific material in a more interesting way. The game interface is shown on Fig. 4. The conversion of the presented numbers has to be solved within a time limit. Results can be saved and a rank list can be made, which would give the competitive character of the game. Adding an element of competition motivates and at the same time energizes students.
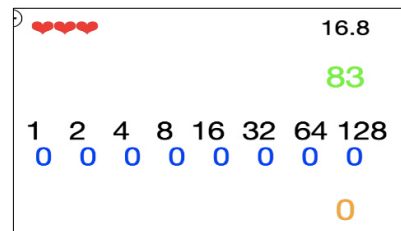
Fig.4. Decimal-Binary number system conversion game

D. Creating applications for extracurricular activities

The extracurricular activities are an excellent opportunity for students to apply obtained knowledge in a problem-solving situation. As a part of the activities of multiethnic section we have created an application for promoting a multicultural state in our country. Using this application students have a chance to learn more about famous Macedonian citizens. They are organized in various categories like: science, historians, musicians etc.

The game interface is shown on Fig. 5. The application is made bilingual, so the students can choose the language they prefer. Flash card with a picture of a famous citizen is presented on the screen, so the student should recognize the person, and write a name in a text box.

Fig.5. Applications created by a student group

Application also includes a quiz with questions that should be answered by the students. For every correct answer student gets a point and for every wrong answer there is a notification.

V EVALUATION AND DISCUSSION

Developed interactive educational applications were evaluated with the students, teachers and parents.

Students from a sixth grade were included in the evaluation process. They were divided in two groups: creators and end-users. Students that were involved as creators of the applications highlighted the advantage of working with TouchDevelop, and stated that the creation process was interesting and fun, and that they learned a lot from each other. The end users, which used the developed applications, were also very satisfied with the learning methods, emphasized that this type of learning allows them to learn everywhere and at any time.

Teachers also expressed their satisfaction to actively participating during the application design process, with their own ideas and suggestions. During the evaluation process teachers also kept track of a students' progress. At the end, they have stated that the student motivation, especially for students who have problems with the traditional ways of learning, has increased, as well as the students' outcomes. Teachers also highlighted the necessity for the development of a larger number of educational applications, which will be adapted to the curriculum materials.

Parents also expressed their positive opinion about this new method of learning, which gave them a possibility to study together with their children.

VI CONCLUSION

The use of interactive educational applications and games in the school curriculum proved to be an effective method among students for learning different subjects. Creating interactive applications can not only contextualize learning but also offer a huge stimulus for students and teachers in achieving learning outcomes. They can transform education, engage students and personalize learning.

In this context TouchDevelop environment offers huge opportunities. TouchDevelop allows all user groups to actively participate in application developing process, thus adapting it to the needs of the students.

In this paper we have presented several applications developed with TouchDevelop. The evaluation has shown that the developed applications have stimulated collaborative learning, increased socialization, and strengthened teacher-student relationship.

In the future, teachers can take additional steps to promote these practices in and outside the schools, in order to enrich the database of educational applications, and to meet the interest of a larger number of students.

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Creating Interactive Map with OpenLayers

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Abstract – Maps are a powerful tool for geographic data presentation. Interactive maps a computer-based tool designed to collect, manipulate, analyze and visualize geographic data. They can be used also as a new teaching and learning tool for teachers, to conduct problem-solving active-ties in the classroom, and for students, to explore geographic issues. This paper describes the process of creating interactive map of Republic of Macedonia using OpenLayers. The application allows visual presentation of some geographic and statistical data for Republic of Macedonia, like: region-al borders, location of cities, presentation of some important information about selected city, population density for re-goons and cities, total number of men, women and children etc.

I. INTRODUCTION

The popularity of interactive maps within the past few years has been increased significantly. The ac-accessibility of free services such as Google and Bing Maps, allows online mapping to be used by every-one, and everywhere.

The opportunities that interactive maps provide can also be used in an educational process. Teachers can use it as a supportive tool to improve the teach ing process, to engage and to motivate the students.

Students can also take and advantage of using interactive maps, because the data are easier to visualize and understand, and the subject is easier to learn.

Interactive maps can help the students to focus more deeply into the course material, and to learn more about the real world [1].

Interactive maps which are based on OpenStreetMap, Bing Maps, Google Earth or Google Maps, give very unique opportunity and viable option to add stimulation to students while learning by focusing on locations and places [2]. They can be improved in the classroom curriculum in many diferent subjects like geography.

However, the research of the impacts of interactive maps on education is still quite limited. One of the first publications of using digital maps in education is the article by Robert Tinker [3], who explored the possibilities of representing data with digital maps in many curricula. Koussoulakou and Kraak's [4] have also experimented with animated maps. They have made a comparison of use of animated maps to static maps for analyzing patio-temporal data. MacEachren et al. [5] have tested controls for map animation and other interactive tools for map manipulation. More recently, several studies for using interactive maps in education process have been conducted. They have reported that students generally prefer using interactive, web-based maps over static, paper maps [6, 7, 8, 9].

In this paper we will present an interactive map of Republic of Macedonia, created with OpenLayers. OpenLayers is a free, open source, tool which allows creating interactive maps. It provides both novice developers and professionals with a robust library, for creating modern, fast, and interactive web-mapping applications for desktop and mobile devices. Created interactive map, can be used in geography classes.

II. OPENLAYERS

OpenLayers is an open source toll developed by Metacarta [10]. It is JavaScript library for making interactive web maps, which are viewable in almost all web browsers. OpenLayers is a client side library, therefore there is no need to download anything be cause it not requires any special settings or software. First version of OpenLayers was published in 2006, in part, to Google Maps.

With OpenLayers you can build entire mapping applications from the ground up and customize different things of your map such as: layers, events, controls, etc. Also, you can use more and different map server back-ends together, as well as vector layers. You can draw lines, polygons, circles, etc., with different styles.

Maps created with OpenLayers are interactive, so users can enable or disable the visibility of layers, they can zoom and drag the map, click on the markers to show some data about selected geography location etc. One of the advantages of OpenLayers is that you can customize your map with the design you prefer of a website.

With OpenLayers you don't need to be a programmer to create an interactive map because it is very simple to use.

III. CREATING INTERACTIVE MAP WITH OPENLAYERS

Interactive maps are more interesting for the students than paper maps because they allow better visualization of data. Various software exists for cre-ating interactive maps. In our case we have used OpenLayers free, and open source solution that allows data visualization retrieved from different sources.

With the help of OpenLayer we have created an interactive map of Republic of Macedonia which allows visual representation of some geographic and statistical data for our country. This interactive map contains different layers which enable a rich presentation of the data.

The basic layer is the layer that shows the countries of the Europe continent, so the students can acquire some basic knowledge about every country, like: location, border states etc. (Fig.1).
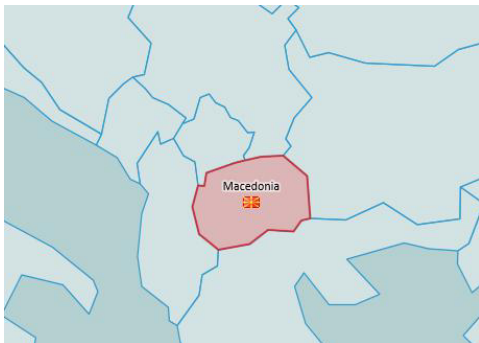

Figure. 1. Map showing the location of Republic of Mace-donia

The second layer shows the basic map of Republic of Macedonia. By clicking on this map the next level, showing the regions in Republic of Macedonia, is presented (Fig. 2).
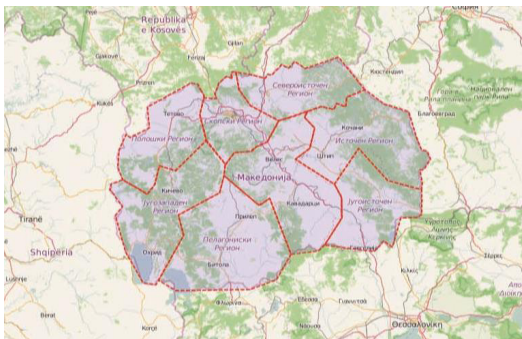
Figue. 2. The basic map showing the regions of Republic of Macedonia

The population density of the region is presented using different shades of red colors. The darker colors indicate regions with higher density, while the lighter colors indicate regions with lower density. This allows student to easily distinguish the regions, and to learn about population density.

This map also employs highlighting on mouse-over to allow students to get into details easily and to support open-ended exploration. When students mouse-over a region, that zone is outlined in red and the fill color becomes more saturated. Double-click on selected region, will show that region enlarged with the towns located in that region.

Each town is presented with the name and picture, which is made clickable (Fig. 3).
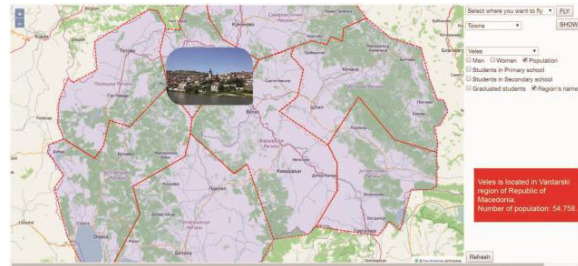
Figure. 3. Presentation of the data about particular town

Clicking on the particular picture, a larger image appears that shows the selected city together with some important characteristics about it. The same information can be obtained using a dropdown box, which lists all the cities of a selected region. This allows student to choose the preferred way of interaction.

On the right side of the map, various commands (dropdown boxes, checkboxes, and radio buttons) are available (Fig. 4). They allow various data to be presented on the map, like: population density (about region and towns), number of men, women and children, fertility rates, mortality rates etc.
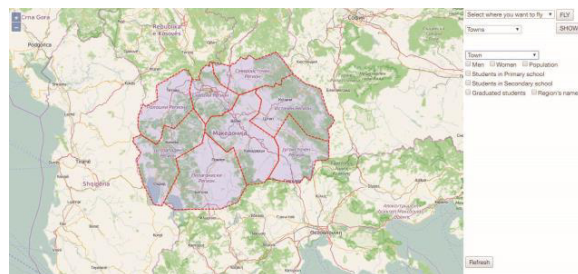
Figure 4. Map with various commands used for data manipu-lation

Also various animation effects (pan, rotate, fly to etc.) are also implemented in this map.

IV. Conclusion

The rapid developments of information and communication technologies have changed the notation and the way of teaching and learning in the past decade. In this context interactive maps, could be seen as a useful and effective tool that provides inquiry-based learning experiences in the classroom. They support interactive learning, interdisciplinary learning, multiple representations, and multiple linkages of information. Because of this they are very popular with students, who prefer using interactive maps, over static, paper based maps.

In this paper we have presented an interactive map created with OpenLayer, which can be used in school geography education. This interactive map, which is web based, allows various ways of interaction forms for manipulating data representations. Geographic and statistical data of Republic of Mace-donia are presented with the help of this map, so the students can learn more about specific town and re-gion in Republic of Macedonia.

In near future we plan to conduct an experiment with end users, in order to get feedbacks which will help us in further application development.

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Running and Testing Applications for Contiki OS Using Cooja Simulator

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Abstract - Contiki OS is operating system for the Internet of Things. Contiki runs on a range of low-power wireless devices. These devices often make up large wireless networks. Developing and debugging applications for such network is really hard. To make this process easier, one can use Cooja. It is a Contiki network simulator that allows developers to run and test their applications on fully emulated hardware devices. It allows developers to test their code before running it on the real target hardware. Also, it can be used in educational purposes for students on graduating courses.

I. INTRODUCTION

Internet of Things (IoT) is a concept and a paradigm that considers the pervasive presence in the environment of a variety of things/objects that through wireless and wired connections and unique addressing schemes are able to interact with each other and cooperate with other things (objects), to create new applications (services) and reach common goals [1]. The objects are often grouped into networks as wireless sensor networks (WSN). The nodes in the networks are resource constrained. They often have 8-bit microcontrollers and constrained RAM and ROM in kilobytes (about 20 kilobytes of RAM and 100 kilobytes of ROM) [2]. These networks contain a large number of tiny sensor devices with wireless communication capabilities. The goal of the Internet of Things is to enable things to be connected anytime, anyplace, with anything and anyone. IoT has three main parts: the things which are embedded with sensors, the networks that connect them, and the systems that process data to or from the things. Appliances, vehicles, wearables are just some of the objects that will be connected and will make our lives easier and more efficient. IoT will have a huge impact on industry development and industrial production (intelligent transport solutions, smart electric grids, machine monitoring using sensors, data-driven systems) [3]. Devices can be connected using mobile technologies such as 2G, 3G, 4G, 5G (the newest), or the wireless technologies such as Zigbee, Wi-Fi, 6LowPAN over Zigbee, or Bluetooth. The number of Internet of Things devices will grow exponentially in the coming years (Table I). Looking to the future,

TABLE I. INTERNET OF THINGS DEVICES

World Population	6.3 Billion	6.8 Billion	7.2 Billion	7.6 Billion
Connected Devices	500 Million	12.5 Billion	25 Billion	50 Billion
Connected devices per person	0.08	1.84	3.47	6.58
Year	2003	2010	2015	2020

Cisco estimates that IoT will consist of 50 billion devices connected to the Internet by 2020 [4].

Contiki OS is a lightweight open source operating system for the Internet of Things [5]. It was developed at the Swedish Institute of Computer Sciences by Adam Dunkels et al. It is written in the C programing language and all programs for it are also in C. Contiki is a highly portable OS and it has already been ported to several platforms running on different types of processors. The most platforms often use Texas Instruments MSP-430 as well as Atmel ATmega series of microcontrollers [6]. Contiki uses event-driven programming model to handle concurrency. All processes share one stack, allowing savings of memory. It is the main advantage of the Contiki. Protothreads are used to realize this model. Protothreads provide conditional and unconditional blocking wait and they use local continuations to save the state when it blocks. When the Protothread is resumed, it jumps back to the next instruction [7]. Contiki supports both IPv6 and IPv4 stack implementations, along with the recent low-power wireless standards: 6lowpan, RPL, CoAP. It also uses Rime stack [8]. It is a lightweight communication stack for sensor networks and it has thinner layers than traditional stacks. The layers are simple and they have small headers (only a few bytes). Rime also supports code reusing and the main purpose of this protocol is to simplify the implementation of sensor networks. Contiki is used in numerous systems, such as electrical power

meters, industrial monitoring, alarm systems, remote house monitoring, city sound monitoring, and radiation monitoring, street lights. The latest version of Contiki OS is Contiki 3.0 (released on 26.08.2015) [11].

Cooja is the Contiki network simulator. It is Java-based application with a graphical user interface (GUI based on Java's standard Swing toolkit) [10]. Cooja also support simulation of the radio medium and integration with the external tools to provide additional features to the application. It can simulate large and small networks of Contiki motes (simulated sensor modules). Motes can be emulated on less detailed level, which is faster and allows simulation of larger networks, or at the hardware level, which is slower but allows precise inspection of the system behavior [5]. This tool has two emulator software packages: Avrora and MSPSim. Cooja use Avrora, for emulation of Atmel AVR-based devices, and MSPSim for emulation of TI MSP430-based devices. The most platforms have MSP430 microcontrollers [10]. That is the reason why MSPSim is the most used software package for simulation of WSN. Cooja can emulate multiple platforms like: TelosB/SkyMote, Zolertia Z1 mote, Wismote, ESB, MicaZ mote. It is a very useful tool for Contiki OS application development and debugging. It allows developers to test their code and systems before running it on the real target hardware, to estimate power consumptions of nodes in simulations or to show radio transmissions and receptions.

II. CONTIKI BUILD SYSTEM

In our scenario we use the latest version of Contiki 3.0. Unlike other versions of Contiki, this version has some improvements such as: Cooja improvements, MSPSim improvements, new regression tests, new platforms, new radio API, IPv6 stack improvements, implementation of MQTT protocol, CoAP protocol updates, HTTP socket and others [5]. We used Instant Contiki 3.0 development environment. It contains all the tools and compilers needed for Contiki development and debugging. It is open source and can be downloaded and test at any time. Contiki is licensed under the 3-clause BSD license. This license gives everyone the right to use and distribute the code, either in binary or source code format, as long as the copyright license is retained in the source code [12]. VMWare Workstation 10 Virtual Machine Player is used to load and run Instant Contiki image. In the Home directory, we can see two folders: Contiki and Contiki 3.0 that contains all tools, libraries, platforms, documentations, or examples.

TABLE II.   MULTIPLE TYPES OF MAKEFILES

Makefile	The project's makefile, located in the project directory.
Makefile.include	The system-wide Contiki makefile, located in the root of the Contiki source tree.
Makefile.$(TARGET)	Where $(TARGET) is the name of the platform that is currently being built
Makefile.$(CPU)	Where $(CPU) is the name of the CPU or microcontroller architecture used on the platform for which Contiki is built
Makefile.$(APP)	Where $(APP) is the name of an application in the apps/ directory

With Contiki build system we can easily compile Contiki applications for different hardware platforms by simply supplying different parameters to the make command, without editing Makefile or application code. Makefile contains the instructions for the compilation tools. As we can see in the Table 2, there are multiple types of Makefiles that are used to compile code. The Makefile project directory specifies where the Contiki source code resides in the system. "Makefile.include" contains all C files of the core Contiki system [12]. It is located in the root of the Contiki source tree. It includes Makefile. $(TARGET) and all applications Makefiles in the APP list (specified by the project's Makefile). Makefile. $(TARGET) contains a list of C files that the platform adds to the Contiki system. It is located in the platform/$(TARGET)/ directory and it also includes Makefile.$(CPU) from the CPU/$(CPU)/ directory. Makefile.$(CPU) contains C compiler used for the particular CPU. It can contain different C compilers (using conditional expression) or it can be overridden by the specific platform Makefile. The project Makefile can also include APPS variable that display a list of applications from the apps/ directory in the root of the Contiki source tree.

```
CONTIKI_PROJECT = hello-world

all: $(CONTIKI_PROJECT)

APPS += powertrace

CONTIKI = ../..

include $(CONTIKI)/Makefile.include
```

Example of the Makefile on the HelloWorld project is shown in the above code. CONTIKI variable defines the location of the Contiki source code. CONTIKI_PROJECT is the name of the application. APPS variable includes the powertrace application from the app/ directory.

We can show how Contiki build system work by the example hello-world project in the examples/hello-world. We can build the application by running the command "make", in a directory examples/hello-world. In this way, the Contiki system is built using the native target (it builds an entire Contiki system as a program that runs on the development system) [12]. The command:

make TARGET=z1,

is used to compile the application and a Contiki system for the Z1 Zolertia platform. We use the command

make hello-world.ce,

to compile the hello-world application into stand-alone executable. Then it can be loaded into a running Contiki system. To set a target platform, use a command:

make TARGET=z1 hello-world.ce.

To save the selected target as the default target, use a command:

make TARGET=esb savetarget.

A file named as Makefile.target is saved in the project directory. It contains a currently saved target. "DEFINES=" is used to set arbitrary variables for the C preprocessor in the form of comma-separated list. We can save "defines" with the command:

make TARGET=z1 DEFINES= MYTRACE, MYVALUE=4711 savedefines

A file named as "Makefile.z1.defines" is saved in the project directory, containing the currently saved defines for the Z1 platform [12].

III.   Structure of Contiki Program

In the following part of our paper, we present a simplest Hello-world Contiki program, which contains the main components of any Contiki program [13].

1: #include "contiki.h"

2: #include <stdio.h>

3: PROCESS(my_first_process, "Hello World Process");

4: AUTOSTART_PROCESSES(&my_first_process);

5: PROCESS_THREAD(my_first_process, ev, data)

6: {

7: PROCESS_BEGIN();

8: printf("Hello Contiki World!\n");

9: PROCESS_END();

10: }

The header file "contiki.h" contains all the declarations of the Contiki operating system [14]. stdio.h header file is included because we have used printf() function inside the program. The third line shows the declaration of a new process. The first parameter of the PROCESS Macro is the variable for the process and the second parameter is a string name of the process. AUTOSTART_PROCESESS shows that the process should be started in the Contiki operating system startup. Fifth line is a definition of a process. The first parameter in the process (my_first_process) is a process variable. The second parameter (ev) is the event parameter. It is used to make the program responding to events in the system. The "data" parameter is used to receive some data from those events. PROCESS_BEGIN and PROCESS_END display the start and the end of any Contiki program. The "printf" function is used to print the string "Hello Contiki World!". If we compile this code and run in the terminal, the string in the brackets will be printed in the terminal. If we compile the code in Cooja Network simulator, the string will be printed in the Mote Output Window.

IV.   Running Cooja Simulation

A. Starting Cooja

In "Contiki 3.0/tools" directory are located tools such as: powertrace (used to estimate power consumption), release tools; collect view, cygwin, tunslip and Cooja.

Cooja can be started from the terminal using a command (Fig.1):

ant run,

but first, we must go to the Cooja directory in the terminal:

cd contiki 3.0/tools/Cooja

Cooja will start with a blue empty window, when it is compiled. Now we can run an example simulation. All examples in Cooja are located in the following path:
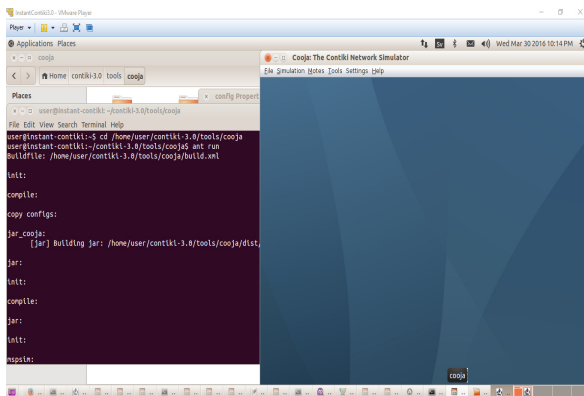
/home/user/contiki-3.0/examples

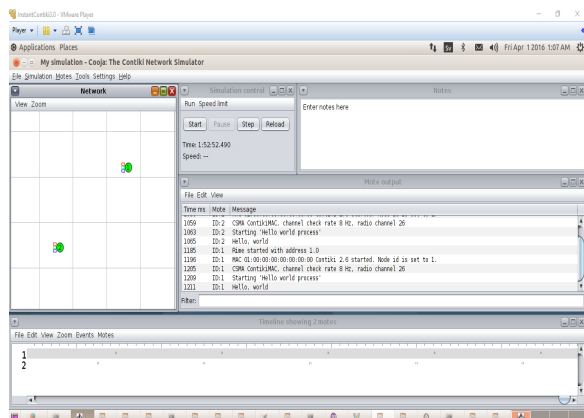Figure 1. Cooja – The Contiki Network simulator

Figure 2. Creating new Cooja simulation

B. Creating new simulation

We can create a new simulation using the main menu command:

File->New Simulation

It will display a "Create new simulation" window. We should enter the name of the simulation, and the advanced settings such as Radio Medium, Mote startup delay, Random seed. After creating a simulation, Cooja display all simulation tools (Fig.2) such as: Network (show all nodes in the network), Simulation control (panel used to Start, Pause, Reload or Executing Steps of the simulation), Mote output (Show output for the nodes), Timeline (Simulation Timeline that show channel change, LED change, log outputs) and Notes (Notes about simulation) [15].

C. Adding motes and running the simulation

To add motes in the simulation we have to do this in the main menu of Cooja:

Motes->Add motes->Create new motes type

After that, we have to choose the type of the mote such as Z1, Sky mote, Wismote, MicaZ mote. The "Create mote type: Compile Contiki" window is

shown. It shows a Description (Mote type) and the Contiki process/Firmware with the Browse button. With the click on the button we have to choose the Contiki application. Then, in the tab Compile commands is shown in the following code:

make hello-world.z1 TARGET=Z1

The Z1 is a target platform or a Mote type name. After clicking on "Compile" a Contiki program is compiled and the output is shown in the tab "Compilation output" (Fig.3). It displays all platform compiled parts and the errors in application (if there are errors). Then, we have to click "Create"
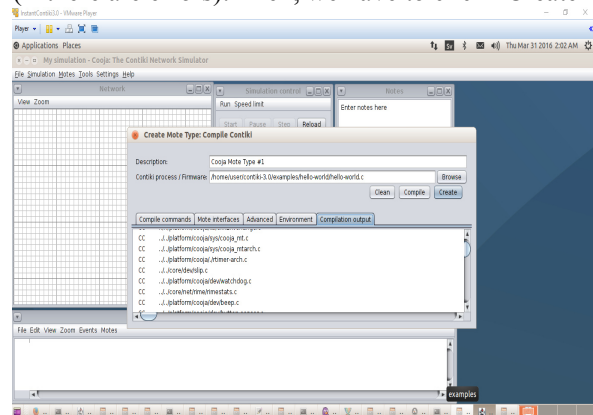
Figure 3. Compiling Contiki program

to add motes in the simulation. The "Add Motes" window is displayed. We have to define: Number of new motes, Positioning, Position interval and to Add motes. After that, the simulation is created. We can now see the motes we added to the simulation in the Network window. To start the simulation, we need to click on button Start.

D. Saving simulation

Cooja simulation can be saved using the command:

File->Save simulation as

Saved file has extension ".csc". In the future we can load the simulation using that file.

In our research, we used the rest-example application simulated in Cooja [16]. It is a client-server application that use the application layer protocol called CoAP (Constrained application protocol). The client establishes a connection with the server and periodically sends data to any of the predefined URL for service discovery (random selection). We run the application on two types of wireless sensor network motes: Sky mote and Z1 Zolertia mote. Sky mote is equipped with 8MHz Texas Instruments MSP430 low power microcontroller, 10 KB RAM and 48 KB flash

TABLE III. MEMORY USAGE OF CONTIKI APPLICATION

text	data	bss	dec	hex	filename
49466	262	6792	56520	dcc8	coap-client-example.z1
45378	210	8496	54084	d344	coap-client-example.sky

TABLE IV. DATA FROM POWERTRACE FOR COAP CLIENT –SKY MOTE

ALL CPU	ALL LPM	ALL TX	ALL RX
12698	314829	5189	2440
23257	631930	7426	6558
30251	952599	8033	9263
37059	1273457	8638	11908
43971	1594209	9332	14629
51165	1914680	9775	17460
62888	2230624	12899	20467
70004	2551172	13463	23315
76901	2871940	14070	26028
84199	3192309	14577	28954
91020	3513152	14998	31701

memory [17]. It has a 250 Kbps, 2.4GHz, IEEE 802.15.4, Chipcon Wireless Transceiver and sensors for humidity, temperature and light, 16-pin expansion support and optional SMA antenna connector. Z1 Zolertia mote is equipped with: 16 MHz MSP430F2617 low power microcontroller, 8 KB RAM and 92 KB flash memory [18]. It has 250 Kbps, 2.4 GHz, IEEE 802.15.4, CC2420 transceiver and sensor for temperature and a digital programmable 3-Axis accelerometer, and a ceramic embedded antenna. Z1 sensor node in Cooja has 8 MHz clock speed, and Sky mote has 4 MHz clock speed. It is the difference between the real wireless sensor module and the module that is emulated in Cooja. It is important for power consumption estimation of Cooja WSN nodes.

V. TESTING CONTIKI APPLICATIONS AND DISCUSSIONS

Low power wireless sensor devices have limited CPU, memory and power resources. Therefore, it is important to test the memory usage of Contiki applications and to estimate power consumption.

A. Memory usage

We can see the memory usage of a Contiki application (rest-example application) in terminal using the command:

size coap-client-example.z1(the name of generated platform file-compiled in Cooja)

From the Table III, we can see the memory usage in different memory segments. "Text" segment shows the code and read-only data in the application. "Data" segment shows the read-write data. "Bss" segment shows the zero initialized ('bss' and 'common') data. "Dec" is a sum of text, data and bss. "Hex" is the hexadecimal equivalent of "Dec". All values are decimal and bytes. Typically, the flash consumption of application will be text+data, and RAM consumption will be data+bss. RAM consumption includes only global data. It will not include the memory consumed by stack and heap, when application is actually executing [19].

Using the data in Table III for memory usage of Contiki coap-client-example application, the flash consumption of Z1 Zolertia mote will be 49728 bytes, and flash consumption of Sky mote will be 45588 bytes. The RAM consumption of Z1 Zolertia mote will be 7054 bytes, and the RAM consumption of Sky mote will be 8706 bytes.

B. Power consumption

To estimate power consumption in Cooja for rest-example Contiki application we have used a tool called powertrace. We have to add this tool in the program Makefile using this line of code:

APPS += powertrace

In the code of the coap-client-example.c file we have to add the following lines of code to print power consumptions in different states:

#include "powertrace.h"

powertrace_start(CLOCK_SECOND * 10);

The value 10 is a Runtime. This means that the values for power consumptions will be printed every 10 seconds [20].

Table IV shows the printed values in several states of the Sky mote in the form of the number of clock ticks. ALL_CPU is the total (high) CPU (CPU in active mode). ALL_LPM is the total number of ticks in a state LPM (Low power mode). ALL_TX is the total number of ticks in TX state (Transmit), and ALL_RX is the number of ticks in the RX state (Receive).

We calculated the power consumption by using the following formula [20]:

TABLE V.   Power Consumption on Sky Mote

Power Consumption (mW)				
CPU	LPM	TX	RX	Total
0.08700348	0.15822148	0.39936676	0.82189087	1.46648259
0.05762878	0.16000177	0.10836639	0.53987732	0.86587427
0.05609619	0.16009608	0.10800934	0.52790222	0.85210383
0.05695313	0.16004319	0.12389832	0.54307068	0.88396531
0.05927673	0.15990298	0.07908783	0.56502502	0.86329257
0.09659454	0.15764418	0.55772095	0.60015198	1.41211165
0.05863403	0.1599414	0.1006897	0.56841797	0.8876831
0.05682953	0.16005117	0.10836639	0.541474	0.86672109
0.06013367	0.15985209	0.09051361	0.5839856	0.89448496
0.05620331	0.16008859	0.07516022	0.54825989	0.83971201
				0.98324314

$$\text{Power consumption} = \text{Energest\_Value} * \text{Current} * \text{Voltage} / \text{RTIMER\_SECOND} * \text{Runtime} \qquad (1)$$

Energest_Value is the difference between the number of ticks in two time intervals (for example difference between ALL_CPU in time interval 20 and 10). We got a value of current for CPU, LPM, TX and RX from the Z1 and Sky mote datasheet [17,18]. The voltage for Z1 and Sky mote is 3V. RTIMER_SECOND is 32768. Runtime is the time interval in which we perform measurements (10 in our example). The total time interval in our simulation is 110 seconds.

Table V shows the power consumption on Sky mote (coap-client-example executed on Sky mote).

TABLE VI.   Power Consumption on Z1 Mote

Power Consumption - mW				
CPU	LPM	TX	RX	Total
0.29196167	0.00029414	0.07949158	0.47608154	0.84782893
0.26678467	0.00029464	0.09175781	0.47608154	0.83491866
0.27479553	0.00029448	0.07678345	0.47470459	0.82657805
0.27287292	0.00029452	0.08920898	0.48399902	0.84637545
0.28060913	0.00029436	0.099245	0.47401611	0.8541646
0.49154663	0.00029014	0.51167725	0.5278894	1.53140342
0.28413391	0.00029429	0.07981018	0.47539307	0.83963145
0.27877808	0.0002944	0.08920898	0.48193359	0.85021505
0.2719574	0.00029453	0.08920898	0.47109009	0.832551
0.28697205	0.00029423	0.099245	0.47883545	0.86534673
				0.91290133

The average power consumption is around 0.98 mW (milliwatts).

Table VI shows the power consumption on a Z1 mote (coap-client-example executed on Z1 mote). The average power consumption is around 0.91 mW.

VI.   Conclusion

Cooja is a Contiki network simulator that simulates a wireless sensor networks. In Cooja we can run and test Contiki applications. With this tool we can estimate a memory usage of applications and power consumption on WSN motes. It can be used in educational purposes for students on graduating courses.

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Education Process and Virtual Reality Technologies

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Abstract - This paper presents our experiences in education of virtual reality in both ways: as subject of study and also as study tool. At the Department of Computers and Informatics, Faculty of Electrical Engineering and Informatics TU Košice (DCI FEEI TU Košice) students can study virtual reality technologies and systems. This subject is relatively young. The study is focused on the acquirement of theoretical knowledge and practical experiences about 3D computer graphics, virtual reality and its technologies. On practical exercises students work in our laboratory (LIRKIS) with the latest virtual reality technologies (e.g. augmented/mixed reality, head-mounted displays, 3D scanning or 3D printing) and create content for them (such as 3D models or appropriate applications). Currently we also have a new technology known as CAVE (Cave Automatic Virtual Environment). For education purposes it is also important to know what students know about virtual reality and its technologies to correctly adjust lessons to the students' knowledge and to the needs of practice.

I. INTRODUCTION

As technology constantly advance in progress for various areas of life, people have begun to examine their current and future potential. New technologies in education are very important either as education tools or as study subject. At DCI FEEI TU of Košice (Department of computers and informatics, Faculty of Electrical Engineering and Informatics Technical University of Košice) we focus to both ways. Our new laboratory LIRKIS is also one way for education supports. LIRKIS (Laboratory of Intelligent inteRfaces of Communication and Information Systems) is the excellent laboratory for research, development and teaching applications in area of parallel, distributed and network computing systems for solving computational processes in the processing of graphics data and virtual reality with a primary focus on information systems and visualization, intelligent interfaces an interaction human-computer (HCI), including the development of network communication environments, allowing searching and quality access to distributed multimedia resources (knowledge stocks) and services and their use in creating and delivery of new knowledge and services including the

development of online platforms to access to multimedia content. New experiences are also in area VR technologies usage in an education of handicapped peoples.

It is excellent laboratory for systems of scanning and visualization of input/output data for management of information systems in the context of communication human-computing system in its parallel, distributed or networked implementation environment. Special attention is devoted to research and development of new flexible and intelligent interfaces of systems based on virtual reality technologies designed to work in the following areas:

- systems for a scanning and a creation of input data (tracking systems, 3D scanning, modeling, simulation)

- visualization engines for rendering the outputs in various forms and controlled using higher level languages for easy handling of objects, including script handling

- parallel, distributed or network systems implementation environments

- human-computer interaction and virtual communication infrastructure and their use in educational practice

Generally, in the laboratory we (and also students) can work at all levels of virtualization sequence, as is depicted in Fig. 1. We work also on some laboratory infrastructure adaptation for handicapped persons in present time.
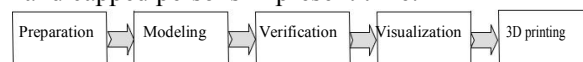

Figure 1. Virtualization sequence

Modeling and visualization phase is improved by using virtual reality technologies. Modeling phase is improved with 3D scanning and visualization phase

with 3D displays, 3D printers and CAVE (Cave Automatic Virtual Environment).

II. LIRKIS LABORATORY AND VIRTUAL-REALITY TECHNOLOGIES

Basic infrastructure in the laboratory covers all levels of virtualization sequence. In this environment students can work during practices or on their bachelor, diploma or PhD. thesis. In addition to this infrastructure other devices listed below are also available for educational process.

A. 3D Scanning

3D scanner is a device that analyzes a real-world object or environment to collect data on its shape and possibly its appearance (i.e. color). There are several types of 3D scanners, which differ in the technology used for obtaining a data.

Contact scanners require a physical contact with the object being scanned. Non-contact scanners use radiation to acquire required information about objects. They are of two basic types: passive and active [1].

B. Augmented Reality

There are several definitions of augmented reality (AR) [1]. One was given by Ronald Azuma in 1997. Azuma's definition says that Augmented Reality: combines real and virtual, is interactive in real time and is registered in 3D. Another one was given by Paul Milgram and Fumio Kishino: Milgram's Reality-Virtuality Continuum. Continuum is visualized as line that is between reality and virtuality.

C. Head-Mounted Displays

A head-mounted display (HMD) is a display device, worn on the head (or as part of a helmet), that has small display optic in front of one (monocular HMD) or each eye (binocular HMD). HMD (e.g. Oculus Rift [2]) are used in virtual reality and augmented reality applications. Another classification of HMDs is based on how the user sees real world. This classification divides HMDs into two categories: immersive and see-through. See-through HMDs have two subcategories: video see-through and optical see-through.

D. 3D/stereo Displays

3D displays use several technologies to create 3D image. Each technology has its advantages and disadvantages. There are several types of 3D displays [3]: holographic displays, volumetric displays (swept-volume and static volume displays) and stereoscopic displays (passive, active and autostereoscopic).
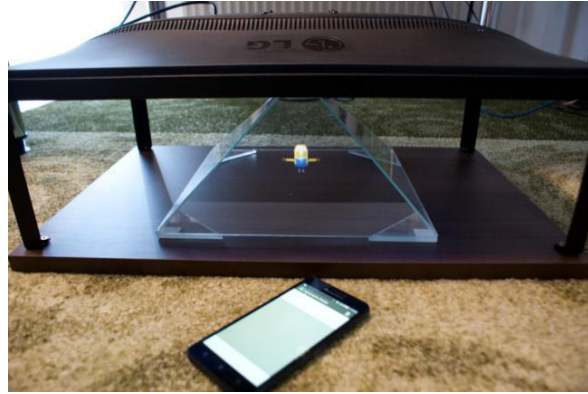
Figure 2. Holographic display created in the laboratory LIRKIS

E. 3D Printing

3D printing is a form of additive manufacturing technology where a three dimensional object (3D model) is created by laying down successive layers of material. 3D printers are generally faster, more affordable and easier to use than other manufacturing technologies. 3D printers offer developers the ability to print 3D models for visualization, testing or direct parts creation.

F. Cave Automatic Virtual Environment - CAVE

It is a room where all walls, as well as the floor and ceiling are projection screens or flat displays.

Figure 3. Virtual cave prototype in LIRKIS laboratory

With the 3D projection and 3D glasses user feels floating in the projected world where he can move around freely. Human motion capture is possible with the camera (e.g. OptiTrack). Mark (Fig. 4) may be affixed to the 3D glasses which can display the scene in the correct viewing angle for an observer. This enables e.g. down movement really look under the table.

Figure 4. Mark for OptiTrack [4] - motion capture system

III. LABORATORY AND VR TECHNOLOGIES EDUCATION

Creation of a 3D model for visualization needs a lot of effort. Everything begins with collecting of information and analysis (preparation phase). When the data are prepared 3D model creation begins (modeling phase). A check of model for errors comes after 3D digital model creation (verification phase). The visualization of the final model is the last step. Students learn about each step on practical exercises, where they create and visualize 3D models. Also students learn how to work with virtual reality technologies and how to use them to improve 3D model creation and visualization process. Practical exercises (based on virtualization sequence) are divided into 3D model creation, 3D scanning, 3D visualization and 3D printing.

A. 3D Model Creation

In this section students learn how to create 3D models, which are used in 3D visualization (using 3D displays or CAVE) and in 3D printing. As 3D modeling applications are used SketchUp [5] and Blender [6]. During practical exercises students learn 3D modeling basics, how to create model using photos, sketches or blueprints, how texture created 3D models and how to set up scene for rendering of single image or entire animation

B. 3D Scanning

In this section students learn how to manipulate and work with 3D scanners Leica ScanStation 2 [7] and NextEngine - e.g. finding the right scanning position, setting the best parameters for scanning or joining multiple point clouds together. Students also learn how to use scanned data to speed up their 3D model creation.

C. Data processing - modeling

Data processing consists of several parts. First, the point cloud (from 3D scan) has to be meshed, i.e. the points have to be connected into a collection of triangles (called faces). The next step is to align the scans from various angles to create the whole object surface. The aligned scans then have to be merged into one continuous mesh, so that no overlapping parts occur. The merging process also involves filling the eventual "holes" (unscanned parts) in the model. Aligning and mesh creation step can be switched if it is required for data processing. Additionally, there is an optional step to simplify the mesh, which consists of reducing the number of triangles in order to save memory needed to visualize the final 3D model.

D. 3D Visualization

3D visualization section is divided into five subsections where students work with:

- anaglyph images – this subsection teaches students how to correctly create left and right image of selected real object (scene) for subsequent easy creation of anaglyph image.

- autostereoscopic 3D display Philips WOWvx [8] – in this subsection students learn which method this display use for 3D content displaying (2D-plus-depth) and how to create content for this autostereoscopic 3D display.

Figure 5. Educational process with autostereoscopic display

- virtual reality system – in this subsection students acquire theoretical and practical knowledge about 3D virtual reality system that combine together 3D displaying system (passive stereoscopic system using INFITEC technology [9]) and position tracking system (InterSence IS-900 SimTracker [10]) to create immersive VR environment. Students also learn how to create content for this VR

system with 3D modeling applications (SketchUp or Blender) and 3D scanning

Figure 6.   Work with Oculus Rift HMD

- augmented reality – this subsection teaches students how AR works and how to create content for AR applications. Fig. 7 shows student working with augmented reality system that use for displaying see-through HMD NVIS nVisor ST 60 [11]. Some results are used also for optimization of workplace in industry praxis.

Figure 7. Student works with augmented reality system including data-glove

CAVE – this subsection uses relatively new technology, which our students can view and directly try. Thus gain an idea of the possibilities using of non-standard 3D visualization. Students also get an idea of the level of immersion (Fig. 8) into the scene, which can be created e.g. using SketchUp or Blender. Using motion tracking they can try free movement in virtual scene same as in real world.

Figure 8.   Students in the CAVE

E.   3D Printing

This section teaches students how 3D printing works and how to manipulate with 3D printer 3D Systems ZPrinter 450 [12], how to prepare 3D models for printing and how to finalize printed models. A student's use for printing their 3D models which were created in SketchUp or Blender.

Figure 9.   Student works with 3D printer

IV.   LABORATORY AND EDUCATION METHODS

In terms of teaching is important for us to know the subject of student interest and the quality of our work in education. We started to watch this issue 5 years ago. Our experiences were published in [13] [14]. Based on these results we improved our education process. Students are trying to learn to correctly understand the 3D virtual system, able to create 3D scenes using different tools (SketchUp, Blender) and inform them about augmented reality and stereoscopy. Naturally, all the appropriate professional level. For

this purpose were created two questionnaires. Students of the Virtual reality systems (SVR) course participate in this survey again.

A. First Questionnaire

The first questionnaire contained 15 questions focusing on teaching the subject (4 – best, 0 – worst):

1. Training in appropriate areas

2. Ensuring literature

3. Explanation of the requirements and criteria of the subject

4. Subject had a coherent approach

5. Demands of the subject was reasonable

6. The lectures were interesting and beneficial

7. The seminars are practical and well targeted

8. Teachers worked professionally

9. Well she managed and had clear teaching speech

10. Students led to discussions

11. Teacher optimum use of didactic equipment and teaching aids

12. Teachers had a welcoming speech and empathetic relationship

13. He managed to keep the boundaries of social communication and worked with humor

14. He communicates well with students and answer questions

15. The subject was important for me and it was interesting

Evaluation of the results obtained from the first questionnaire (Fig. 10): Expertise interpretation, environmental conditions, complexity of the subject and a welcoming speech, the students was very satisfied (<90%). But the gap remains in discussions with students and motivation for practical use (<65%).

B. Second Questionnaire

Second questionnaire was targeted to the interest of a specific VR element in LIRKIS laboratory. Students have possibilities to try autostereoscopic 3D visualization, AR system with HMD and CAVE.

The results show the CAVE helped to pick up the attention, interest laboratory and also the technology itself (63.64%). On the second place was autostereoscopic 3D visualization (22.43%) and finally AR system with HMD (13.94%).
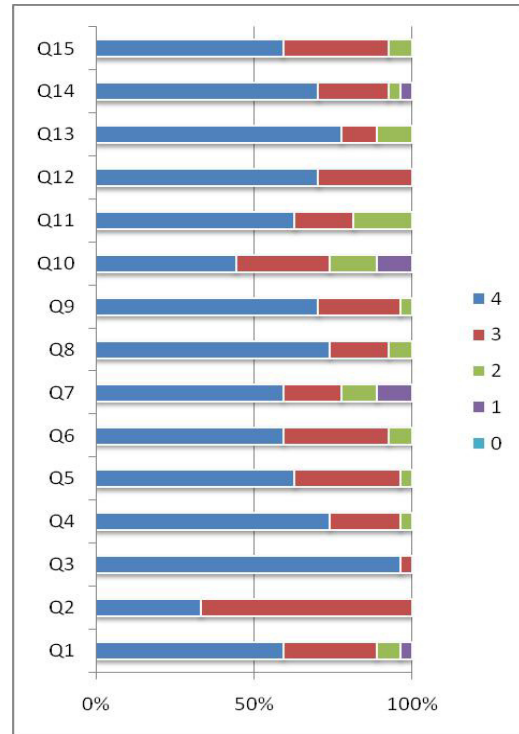

Figure 10. Graph showing the results of the first questionnaire

V. CONCLUSION

Virtual-reality technologies and similar technologies have the greatest progress in present. These technologies allow the creation of previously impossible procedures. These procedures especially their visual aspect and interactivity may change streamline and shorten the process of interaction between human and computers (e.g. also in understanding of formal methods). Our experiences say also that students are fairly satisfied with teaching, communication and technical equipment. They also consider the seminars and lectures for sufficient professional and well explained (up to 90%). Minor deficiencies but not the major motivation for the practical use and student leadership for discussion (up to 65%). Another significant step forward was to draft a CAVE system, which greatly appreciated the students for their interest in this technology. They also indicate the results of which showed almost 64% more interest compared to autostereoscopic 3D visualization and AR system with HMD. Anyway this represents a growth compared to the previous results. It confirms the right step to put this subject into education process at our department.

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Game Theory in Cinematography: Model implementation in Microsoft SQL environment

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Abstract - This study focuses on the analysis of cinematographic work which contains elements of the Game Theory, on the basis of which is made a model and the actual implementation of the database in Microsoft SQL environment. In short there will be explained concepts of the Game Theory, after which it allocates the best Game Theory's examples. However, what makes this work unique is the fact that there is no similar database such as this one. After the implementation, this work focuses on the analysis of the collected data and their entry in the database. Special section is devoted to the way in which data are collected and analyzed. The main idea of this work is to collect a large number of cinematographic achievements with as many details in order to create a unique database that will serve both experts in the field, and students in improving their knowledge and use of the same in the research in the future. Furthermore, one of the primary objectives is to help students to combine knowledge from several areas in order to understand better any academic material.

I. INTRODUCTION

Game Theory represents a natural science that deals with the study of the relationship of conflict and cooperation. The concepts of the game theory are applicable whenever we have more players with our goals, and these concepts helps us to understand, analyze, formulate and structure the different scenarios that they face. These players can be ordinary people, groups, and companies and so on.

The subject of this study relates to the analysis and process of situations that contain elements of the game theory. However, these are contained in the most famous achievements of the film industry, which will later be consolidated within a single database. All examples show the situations that the players face and explain how to solve them. Afterwards, they use model database itself to implement it in Microsoft SQL environment, which by that time will contain all collected and analyzed situations. Based on theoretical knowledge regarding the basic concepts of the game theory, its characteristic games and applying knowledge of strategic decisions will show all their options at any given moment, as they turn the game in their favor,

or bring the best decisions or even find the best alternative. Never the less, the scene of the occurrence of one of the most popular concepts of equilibrium will be processed, and explained how John Nash came to it while he was sitting in a café bar with friends in the relaxed atmosphere during the evening. Also, the basic concept of the Game Theory will be explained, as well as the types of games that exist. However, special attention will be drawn by strategic moves; what they represent and what all types they are.

The focus will be also put on the very concept of a database, what they represent and what they do, underlining the concept of the table, the relation between the table and the extended model objects through which connections the data base will be implemented that will contain all sufficient information gathered by detailed analysis of cinematographic works.

The aim of study is to collect a large number of cinematographic films from as much sufficient information in order to create a unique database that will serve both experts in the field, and students in improving their knowledge and use of the same in the research. Also, one of the objectives is to enable students to combine knowledge from several areas to be studied and later on to better understand the materials.

II. GAME THEORY

Game theory is the study of mathematical models of conflict and cooperation between intelligent rational decision-makers [1]. It is multiplayer decision theory where the choices of each player affect the payoffs to other players, and the players take this into account in their choice behavior [2]. The goal of this theory is to determine the behavior of the participants, which is most favorable to them, assuming that they are rational, and that they think strategically. The conflict is governed by strict rules as defined in social games such as poker, Monopoly, chess and so on. Precise

analysis of such games is what game theory provides. While most of the terms are used in the context of mathematical game theory terminology which is similar to board games, game theory has much wider implementation and it is used for modeling within conflict situations in mathematics, politics, economics, military strategy et cetera.

In the literature we can find many definitions of game theory but the most complete one, which combines many, is:

The game theory represents a mathematical formalization and analysis of the process of rational decision-making in terms of the agreed interest of the participants in the game, conflict or partially conflict of their interests, as well as, in circumstances of risk and uncertainty [3].

Having in mind these facts, it can be concluded that the game theory is multidisciplinary science that is used not only by mathematical knowledge, but also by knowledge of other sciences that can contribute to a better understanding and analysis of human behavior and social processes. However, by using the game theory it is attempted to reduce the gap between economic science from other social sciences, which are also engaged in the study of individual behavior, but in a new, totally different way and for a different purpose.

The concepts of the game theory are applicable whenever the actions of several participants are mutually interdependent as they enable the formulation, design, analysis and understanding of the strategic situation.

The game represents the object of study of the game theory, and it is a formal description of some strategic situation involving multiple players that respect a set of rules and mutual agreements. The word itself refers to a game interaction between two or more sides. In order to this interaction to become strategic, it is necessary that the players are aware of the mutual result.

The most interesting aspects of the game theory consist of actions that are mutually exchanged between players as a result of his opponent's awareness of the situation on one side and the creation of its actions regarding the knowledge on the other. What distinguishes the game from the decision is that the decisions occur in situations where each person decides without considering the reactions and responses of others. A simple rule explains the difference: If there is at least two or more players, each of whom react to what others are doing, this is not a game.

In the end, the game can be defined as the interaction between the rational, mutually conscious players, whereby the decisions of each are

influencing the outcomes of other players. The basic properties of the game are:

- Strategic environment
- Rules of the Game
- Assumptions

The solution is a way of playing the game; it is a prediction of what would any rational player who participates in a given game achieve if one adheres to the selection criteria. The result of rational behavior of all players in the game is a solution. In the game theory, a term that represents the solution to a game is called equilibrium, or balance of the game. The equilibrium is in fact a set of optimal strategies that players need to play in order to achieve their objective and maximize their score.

The use of the game theory is very present and extensive. Strategy games are present in both private and business life; in the functioning of the economy, society and polity, in sports and other serious activities, as well as in other areas related to economics, negotiation, auctions, market structure, politics, military strategy et cetera. It is possible to extract three fields of use within the game theory [4]:

- Explanatory (explanatory)
- Prediction
- Prescriptive (consultative) role.

III. IMPLEMENTATION OF THE MODEL

The data and the way in which they are used can be understood differently by end users, developers and designers. Precisely this is the biggest problem in the development of databases. In order to provide accurate and understandable description of all of the data and the way in which they are used it is necessary to produce a clear model that is not entirely technical. The most commonly used model in practice is an extended model objects-connection. The main component of this approach is the concept of objects and their interconnections.

Modeling via extended model objects-connection includes:

- A set of entities
- Spotting limits
- Define Keys
- Graphic view
- Defining attributes
- The design of a global scheme

- Reconciliation of the global scheme on relations.

The aim of this study is to produce a database which will contain all necessary information about the cinematic achievements that contain elements of game theory, but with the ability to support all the possible expansion and eventual changes and adjustments in case of possible improvements. Specifically, for movies it is necessary to know all the details, as well as the details of the game itself, which inputted in the form of a code book.

The GameKid table contains, besides the primary key that identifies only names of the games, while the detailed narrative description is contained in the table known as the GameKindDetails. Separately from the title game, there are GameType and GameSubtype tables that contain all sorts of games (Figure 1). Also, StrategicMoves table shows what all strategic moves there are; showing their short description and classification. The answer to the question that better explains what is the credibility of these moves and what is the way in which the credibility has been achieved, is defined in the CredibilityType, AchievingCredibility and Credibility tables.

As far as the realization of cinematographic achievement is concerned, the name of the achievements, both in Serbian and English language, as well as all other relevant information (year, release date, and duration) are contained in the main Movie table. Due unloading a database, as well as performance improvements a MovieDetails table has been created. A table that contains a link to a film trailer, cinematographic fulfillment, a brief description and a budget. It is noteworthy that one impression in the table MovieDetails fits only to one cinematic achievement in the Movie table. As one cinematic achievement can be recorded in a co-production of more than one country, it was necessary to make an aggregation MovieCountry that contains information explaining what
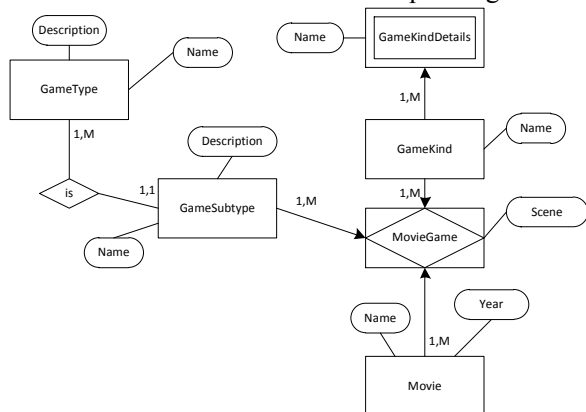
achievements come from what country, but with an indication explaining what country has priority. Country table is pre-filled as the codebook with the names of all countries. In a similar way, a solution is found regarding what language is spoken in the film. Genre table contains the names of all cinematographic genres that by lowering its primary key in combination with the primary key table in the MovieGenre table unambiguously determine which cinematic realization is of which genre.

The biggest challenge was to model the part responsible for appearance of the cast and production team that took part in the realization. The optimal solution is taken to make the Person table containing all the information of persons (name, last name, middle name, date of birth, height, zodiac sign, a nickname, a city of born and a short biography) without setting the details of the role that the person has in its cinematic realization. Because of the role in the realization of where one person at a time can have many different roles, for example, to be both director and actor (a common occurrence in embodiments where director Quentin Tarantino) created table PersonType table containing only the names of all roles that exist (actor, director, screenwriter, lyricist), and a table that is PersonPersonType aggregation between Person table and PersonType containing information about individuals and their roles. By solving the problem of the roles that have been through a lot of achievements it is easy to make a final solution to the aggregation of another MoviePersonPersonType providing information to people with specific roles that participate in the certain realizations. At the very end, the Movie Game table and the Movie Strategic Moves are aggregations containing information of achievements that include games, specifically, strategic moves, kind of games, as well as, the way in which values the credibility of strategic moves that is played.

In addition, the Questions table has been created, which contains questions, textual description of query that should be created by students, which fulfills one of the goals of creating a database, and that is to combine knowledge from several areas, as well as mid-career training.

Such modeling led to the clean and transparent data without redundancy where for each achievement all the necessary information is available by joining a pair of tables. What represents the main advantage is the fact that such a modeled base leaves a space for eventual expansion to other spheres that link to next elements of game theory, which can be interesting to research work and data analysis.

Figure 1. Part of an extended model objects-connection named Game Theory in Cinematography

IV. DATABASES

The database is a collection of interrelated data stored and available at the same time to a large number of users and applications. Management System (DBMS) is a database server. It forms a physical representation of a base in accordance with a logical structure and performs all operations on the data, such as search and maintenance of data, and competitive use of the same data. The system for database management is based on a specific data model that represents the way we describe, design and implement specific databases. In addition to the data itself, the database contains metadata - database of a database that describes the structure of the database, preserving the integrity of the rules, and so on.

DBMS (Database Management System) is specialized software that is used to create and manipulate databases. It is characterized by the following:

- Provides storage of large amounts of data;

- Provides a methodology of access, search and modification of data;

- Provided parallel data access by multiple users.

Language for accessing the data, by which data is read out, or edit or delete is called data manipulation language (DML - Data Manipulation Language). In order to manipulate data use, the relational database is needed, and that language is known as SQL (Structured Query Language) [5].

Data stored can represent all cinematographic achievements with their properties, as well as elements of game theory related to this realization. All these data are stored in tables where each table must have a unique name. One row (record) in the table assigning a value to represent the attributes that describe the data stored in the column. The database may contain a large number of tables with additional attributes. Between the tables, there may be links that define the way the tables are related.

The most commonly used language to communicate with a relational database is SQL, which is the standard language for relational database management systems for data. SQL language allows, among other things, to create tables, to search and modify existing data, to add new data and to provide administration and gives users rights for operation over the data. Modeling of the base determines the best way that reduces repetition of data and allows fast searches and data access. The tables with their attributes are created by CREATE command [6]. Below you may find an example of the creation of one of the tables in

Microsoft SQL environment using the SQL language.

CREATE TABLE [dbo].[MovieDetails](

[MovieDetailsID] [int] IDENTITY(1,1) NOT NULL, [TrailerLink] [nvarchar](255) NULL, [Description] [nvarchar](max) NULL, [Budget] [money] NULL, [MovieID] [int] NULL,

CONSTRAINT [PK_MovieDetails] PRIMARY KEY CLUSTERED ([MovieDetailsID] ASC) WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, ALLOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]) ON [PRIMARY] TEXTIMAGE_ON [PRIMARY] GO

ALTER TABLE [dbo].[MovieDetails] WITH CHECK ADD CONSTRAIN [FK_MovieDetails_Movie] FOREIGN KEY([MovieID]) REFERENCES [dbo].[Movie] ([MovieID]) GO ALTER TABLE [dbo].[MovieDetails] CHECK CONSTRAINT [FK_MovieDetails_Movie] GO

CREATE TABLE is a command to create a new table, where Movie Details represents the name that must be unique. Thereafter come the names of attributes with data types and constraints.

There are a number of different types of data:

- Nvarchar (255) - string with a maximum length of 255 characters

- Int - integers

- Numeric - Numeric values

- Date - the date

The primary key represents the column in the table that needs to be unique. It must not be repeated and it serves as the identifier. It is defined via the command PRIMARY KEY, which represents the limit. In case multiple columns represent the primary key, then it is a composite key.

Example of creating a primary key over column MovieDetailsID within MovieDetails table:

CONSTRAINT [PK_MovieDetails] PRIMARY KEY CLUSTERED ([MovieDetailsID] ASC)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, ALLOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]) ON [PRIMARY] TEXTIMAGE_ON [PRIMARY]

An example of creating the composite key in the GameKidDetails table which consists of GameKindID and GameKindDetailsID columns:

CONSTRAINT [PK_GameKindDetails] PRIMARY KEY CLUSTERED ([GameKindDetailsID] ASC,[GameKindID] ASC)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, ALLOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]) ON [PRIMARY] TEXTIMAGE_ON [PRIMARY]

If in a column appear values which are defined as the primary key in some other table, than that column is marked with the restriction as FOREIGN KEY.

The order REFERENCES states the name of other table where that column represents the primary key. It should be noted that the value of this column must be defined in the primary table in which they are referenced.

Example of creating an external key in MovieDetails table, where MovieID column represents the foreign key of the MovieDetails table and referenced on the Movie table in which the MovieID column is the primary key:

ALTER TABLE [dbo].[MovieDetails] WITH CHECK ADD CONSTRAINT [FK_MovieDetails_Movie] FOREIGN KEY([MovieID]) REFERENCES [dbo].[Movie] ([MovieID]) GO

ALTER TABLE [dbo].[MovieDetails] CHECK CONSTRAINT [FK_MovieDetails_Movie] GO

NULL / NOT NULL represents limitation that indicates whether the column should have empty fields which cannot be entered.

Through the example of creating MovieDetails table, we can see that only the column that represents the primary key of MoiveDetailsID has a NOT NULL limitation, which means that for each new row in the table must contain filled value that represents the type of integer number (int), while other columns have NULL limitation which means that they can remain unfilled.

IDENTITY (1, 1) is a counter which starts from 1 and thereafter each time the initial value of the column is increased by 1 when adding new rows in a table. Identity takes up little space and columns over where is placed which often represents the primary key [6].

Example of use can be seen above the column MovieDetailsID while creating MovieDetails table:

[MovieDetailsID] [int] IDENTITY (1, 1) NOT NULL

Entering data into the database is executed through the following commands:

INSERT INTO TABLE table_name (list_of_attributes) VALUES (list_of_values)

Example:

INSERT INTO Person (Name, Lastname, MiddleName, DateOfBirth, Details, Height, PlaceOfBirth, AlternateName, StarSign)

VALUES ('Russell', 'Crowe', 'Ira', '1964-04-07', ' some bio', '182', 'Wellington, New Zealand', 'Russ', 'Aries')

Person represents table in which data is entered. Fields in brackets represent the attributes that characterize the table, while values in brackets after VALUES key words represent attribute values in the order specified after the name of the table that must match the data type defined when creating the table. Because the set of the IDENTITY columns MovieDetailsID and PersonID values are automatically entered, it is not possible to make manual input.

V. USE OF DATABASE

The motivation for writing this work arises from the desire to create a unique database that will contain as much information of the elements of the game theory in cinematography. Having in mind that nowadays anything like this currently does not exist, my personal opinion is that this work will serve the students to improve their knowledge but also to combine their knowledge in various areas. The desire of the author to be in the future engaged in educational work has had a major impact on the selection of this topic. In this manner the game theory, databases and personal satisfaction is connected in one unit. The desire focused on the idea that this work provides insight into the advantages of databases and thus to help students to improve their existing knowledge in a new and unique way. Data collected by the students would come directly by using the databases and that would mean that at the same time students would successfully carry out research in the field of the game theory, but they would also learn to create all the necessary inquiries using SQL query language. Therefore, the aim is to collect as many cinematographic achievements with as many details besides the current entries.

A. Requests

Requests are formed so that the students can gain expected knowledge and use it in the fields of SQL language but also in the fields of the elements of the game theory. Some of the queries from which the students are expected to find a solution are:

- To find all the movies in English with marks over 7.5, that contains elements of the game Prisoner's dilemma;

- To find link movie trailers of all the films in which the same person is both an actor and director;

- To find all the actors that play in the film where the credibility is gained by changing payments.

B.   Necessary knowledge for solving

As already noted, by solving the queries students would already fortify and upgrade materials from the field of the game theory, but however, they would also progress and gain new knowledge using the SQL language. In addition to overcoming the same syntax and data extraction from students, it would be expected to analyze the whole system and its architecture.

By using SQL language students should use various types of operations to merge table (INNER JOIN, LEFT JOIN, and OUTER JOIN). Almost inevitably is to use the WHERE clause, which represents the set of conditions in order to display only certain data. A number of issues also require the use of the GROUP BY and HAVING statements.

In addition to basic statements and their use for resolving queries, it is needed to use functions such as:

- UPPER () - exit from the query, which is included in the function, presented in capital letters

- GETDATE () - exit of the query is current systemically date

- SUM () - calculating sums of certain columns

- COUNT () - counting the number of entries in particular column.

At very least, more advanced knowledge is expected from students in order to solve requirements that need the creation of stored procedures for data entry.

VI.   CONCLUSION

We could freely say that in the past few decades, almost no area of analysis and mathematical modeling of various phenomena did not leave so huge expansion and development as is the case with the game theory. The game theory provides a mathematical recipe for understanding, accepting and coping with a seemingly hopelessly chaotic world. The modern game theory focuses on to clarify the general principles of human reasoning and thus conclude what adjudicate when making decisions.

All of the examples lead to the same conclusion, which is that all people each day participate in a lot of games, no matter whether they are aware of or not. However, a lack of understanding of the game theory puts them at a disadvantage plate when playing against those who understand and serve smartly with it. Accordingly, it would be good for all of people to learn the basics of the game theory, to learn how to act and interact with other people in order to achieve high scores and their goals, because the world we live in is ruthless and cruel, so being in it requires a lot of knowledge and skills in order to survive in it. This is the main reason why the database has been created, to gather all the information and to put it at the disposal of the entire available scene within the frame cinematographic fulfillment, its analysis and its own outcomes.

The desired results of the research came by collection the right data, more precisely, the detailed analysis of movies were formed as a base from which all the information was collected. Basic research methods that were used in the preparation of this research was the study of the Professional literature related to the game theory, large amount of available articles and forums and shared experiences on the elements of the game theory that could be easily present in everyday life, as well as in cinematic achievements. It was estimated that this research method was the most suitable because there was a large number of users around the world that shared their knowledge and experience on implementation of the game theory in the forms of articles in various forums, while some of them even translated their experiences, recommendation and advices into a book.

A large amount of summarized and analyzed data within one database represents an excellent basis to both, professionals in the field of research and assistance with work, and students in learning, writing essays, and connecting knowledge from several areas which was one of the main goals of making this research. Using the Questions table that contains requirements, students can practically apply the acquired knowledge in subjects related to the database and thus take a step forward to what awaits them after graduation, which is the combination of all gained knowledge during the studies, daily activities and the future workplace.

If by time the databases get filled with sufficient amount of information, the logical step would be to create a data warehouse from the database, and to use it in research related business intelligence, and also to enable students to create OLAP cube for making the systems for reporting and data analysis.

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Educational Games in Math Classes Through Information-Communication Technologies

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Abstract: Students discover their possibilities, develop their abilities, gain and expand experience, learn and create through games. Game is the one which, in the best way, encourages creativity and imagination. Students enjoy playing, they are motivated and positive atmosphere is transferred to studying. By monitoring students, that gain knowledge, by applying educational games, Math teacher notices student-teacher a relationship without stress. Besides studying, game also reveals other characteristics of students bad or good. Competitive spirit, fair play and team work are the qualities which should be developed in work with students.

To use technology in the best way while gaining knowledge it is necessary that all involved in educational program are prepared to apply ICT. The best way to achieve this is gradual introduction of modern technology, safe social network ad Internet platform through educational game.

The key part of the paper is the connection of the educational game "Chasing trophies" and modern technologies by using the Internet, safe social network Edmodo, tablets and smart phones in Math classes.

I. INTRODUCTION

A. The use of educational games in classes

Game is motivationally one of the most powerful educational methods which encourages development of creativity of pupils. Game is powerful instrumentality because the pupil can simultaneously exerts and develop its emotions, learns how to obey the rules, while developing team and competitive spirit. Through game play, pupils builds its self-confidence, explains and express its opinion. Game, as educational method in interdisciplinary program, encourages creative behavior of the pupils through imagination (divergent ideas), logical opinion, emotional detection and inner motivation for studying. For the means of game are similar to means of creative process (divergence, regularly, expressing) it represents the way of developing creative behavior (Šefer, 1996.). Educational game is always in function of making some assigned goals and tasks of educational work. Depending on what we want to achieve with the game and how it is configured, it can take place during the whole lesson or in some parts of the lesson. For example, during the introductory part of the lesson as a motivational mean or as an activity by which we divide pupils in groups, or during the final part of the lesson when we get return information or repeat the learnt through an activity. In class a game should not play out just for fun, it has to have its function, to contribute to achieving before planned task. Game in class realizes its function only when well planned.

Successful use of games in class depends mostly on the teacher. Teacher's role in planning and conducting games is very important and complicated. He/she should provide learning through the game unnoticeably and spontaneously. This way the teacher exposes his/her organizational skills. He/she should pick the game that is appropriate for the pupils, to set clear rules and to make an atmosphere in which every participant is equal and responsible. That will encourage pupils' self-confidence and the feeling of engagement. During the game, by praising and encouraging pupils, teacher strengthens interest in making best possible score.

In order to actualize set goals and tasks of the lesson, it is very important to make correct choice of the game and to realize it appropriately. Choice of the game means setting its place and role in achieving educational program set for the subject and perceive which moment it can help in the process of learning. Content of the game should be chosen, organized and pointed in a way that can encourage pupils to certain activities which help their learning and development.

Choice of the game also depends on the age of pupils as well as composition of the class, special and technical conditions. If needed, teacher can design new game or develop and enrich existing one by some extra demands, having in mind pupils' knowledge, goals, tasks and contents. Game should come to an end and leave time for discussion, trade of opinions and provision of input, as well as suggestions about planning and designing new games.

II. COMPUTERS, TABLETS AND SMART PHONES IN MATH CLASSES

Math classes have its goals which are achieved through certain activities. Goals phrase some changes that appear with pupils after they overcome contents in a cycle of education. Goal of primary school Math classes is to ensure that all pupils have linguistic and mathematic literacy and to improve enough for realization of corresponding Standards of educational accomplishments; to be capable to solve problems out of familiar situations; to express and explain their opinion and discuss with others; to gain motivation for learning and interest in contents of subjects; to get elementary mathematic knowledge which are needed in basic comprehension of phenomena and laws of nature and society; to improve enough for using their mathematic knowledge in solving various problems in life; to get a base for successful continuation of Math education and self-learning. Besides, it is necessary that class contributes to developing pupils' mental abilities, forming their scientific views of the world and versatile development of their personalities.

Progress of modern technology contributed to pupils' use of mobile phones in school and often in class if they have a chance, because the teacher by using frontal form of work is not capable of motivating the pupils. Lack of interest and boredom can be avoided by approaching educational content to pupils using educational means that are interesting and close to them. Computer represents educational mean that pupils are happy to use. Well-equipped computer classrooms with networked computers and wireless internet connection are useful to use, also for tablets in Math class. That way, educational content can be prepared to follow needs of individual pupil. Pupil can be left with a choice of desired rhythm and level of tasks. It is important because dissatisfaction of slower pupils can be avoided. Computer in Math class should not be used just as a basic replacement of blackboard and chock, but one must not excess in the use of computers in class. It depends on the teacher in which situations the pupils will benefit from use of computers.

A. Social network Edmodo

Social networks have great potential as a mean of trading and developing knowledge. With the help of social networks, pupils find help for their homework, seminar thesis easily, they can even learn a new language. Edmodo is a web service which has all the qualities of a social network. It is made for educational workers all around the world and that makes it a special kind of social network, so called professional network. Educational use makes it sort of learning platform. Everything in this network is in function of education and learning. During one's log in, one must enter information about the school, not only about the person. Edmodo allows complete supervise over pupils' work and not only from the teachers, but also from parents that are interested in following their child's progress. Edmodo offers controlled and self-regulating learning.

B. Educational game 'Trophy hunt' in real and virtual classroom

Rules of the game can be changed and can adapt to every educational subject in school. Advantage of the game is that it exclusively depends on creativity of teacher and his/hers readiness to organize the game. Trophy hunt is not limited only to closed classroom, it can be expanded and ideal expansion is the internet.

During the game, it is possible and desirable to divide pupils in heterogeneous couples or groups by throwing dice. It is necessary to take into account pupils that are less successful in this subject comparing to other pupils and make them leaders of the groups. Leaders pick rest of the teammates by throwing dice, so that pupil that gets a bigger number has advantage in picking teammates. After this every group gets a clue in an envelope. It is desirable that every next clue be harder to solve than the last one, whereby it is achieved that pupils solve problems according to their possibilities. In every clue there is as many tasks as the teacher predicts number of pupils in the groups, but the number of tasks is smaller with harder tasks because of the limitation of time. That way, pupil which has higher grades in the subject will solve the basic level task quicker and will be able to support and help the pupil with problem in solving the task. So peer learning and team work is achieved. Bad side is that there is no co-working between groups because it is a competition between them, and a problem that some pupils can maybe take over all tasks while the rest are waiting for answers. As far as for the second problem, teacher can have the key role by keeping track of pupils' development and helping them out if they come to a problem they cannot solve themselves. Pupils are noticed about the necessity of solving tasks from envelopes as well as that right answers lead to the next clue. If pupils have made a mistake, they will not find the next clue so they have to check their answers. The group that answer first to the last task wins the game.

III. CONCLUSION

Through games, children discover their possibilities, develop their abilities, acquire and expand experience, learn and create. Game is the

best way to encourage their creativity and imagination. Children enjoy playing, they are motivated and positive mood is transferred to learning as well. Knowledge gained through game is more lasting than any other kind. Still, learning should not be completely made as a game, only game is used as a mean of learning. Social networks have great potential as a foundation in trading and developing knowledge. With the help of social networks, pupils find help for making homework, seminar thesis and even learn new language easily. Edmodo is a web service that has qualities as a social network. Educational purpose makes it unique learning platform. Everything on this network is for education and learning.

Educational game 'Trophy hunt' in real and virtual classroom gives possibilities for pupils to achieve more success in the subject and solve basic level tasks quicker, so they can help and support other slower pupils in solving it. This is a way to achieve peer learning and team work inside of the group.

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The Validation of Simulation Models

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Abstract - Verification and validation in a computer simulation is done during the development of the model for simulation with the goal to make a precise and credible model. More and more simulation of models are used to solve problems and help in resolving issues for the programmers and users of these models. The creators of decisions who use the information from the results and the individuals struck by the decisions of the models , have a right to be worried if the model and the results are correct. These problems are solved through verification and validation of simulation models.

I. INTRODUCTION

A model is a simplified and idealized image of reality, abstraction of a real system that holds only the important characteristics for the research. The level of abstraction influences the validity of the model that is on the success of the presentation of a real system through the model. Overly complex models are expensive and inadequate while too simple models don't present the system in a right way.
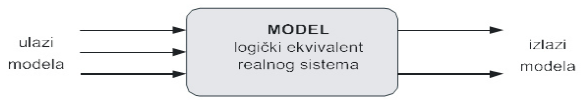

Figure 1- The input of the model – MODEL the logical equivalent of a real system – the output of the model

Models are divided in:

- **Mental** (thinking) models. They are constructed by the human brain and that is how they work.
- **Verbal** models are a direct consequence of mental models, their expression in spoken language.
- **Physical models** represent smaller model of the real system.
- **Mathematical** models are made if the relations between objects are explained through mathematical numeric relations.
- **Conceptual** models are built on the basis of structure, logic of the working system.
- **Computer** (simulation) models are conceptual models presented in a form of a program for a computer through program languages and are very connected to the

development of computer science.

II. COMPUTER SIMULATION

Making of a model and a simulation are expressing a complex activity which contains three elements:

- Real system – organized, codependent elements of a convolution which form a whole and work together to reach the goal. Real system is a source of data, shape x, for the specification of the models.
- Model - abstract display of a system, gives its structure, its components and their interaction. In computer science the model represents a convolution of instructions (a program) which is used to generate the behavior of a simulation system. The model has its objects which are described through attributes and variables.
- The computer – a device for completing the instructions of the model which generate the development of the model in time based on input data.
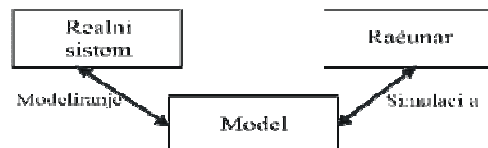

Figure 2- Real system modeling-model-computer- simulation

Computer simulation or a computer model is a program computer network, whose job is to simulate an abstract model of a certain system. Computer simulations became a useful part of a mathematical modeling of a lot of natural systems in physics, quantum mechanics, chemistry and biology, also in economical systems, psychology and social science, as in the process of engineering new technologies with the goal to meet a better insight in its work.

Computer simulations are different from computer programs which are started in only a few moments, while simulations can get done on a level of a local network that is on a group of computers that lasts hours to get started and with more demanding simulations even for days. The scale of

events which are simulated with the computer simulations have already surpassed the possible (even the thinkable) methods which can be solved using the traditional method - paper and pen.

III. TYPES OF SIMULATION MODELS

There are four basic types of simulation models: Monte Karlo simulation is a static simulation which uses the creation of samples from the random variables to solve problems, which can be deterministic and stochastic type.

There are three types of these simulation models:

- Models which are described by ordinary differential equations (there is one independent variable)

- Models which are described by a system with partial deferential equations.

- Dynamic models of a system.

Simulation of discreet events (dynamic) models systems which can be presented with a set of events. An event is a discreet change of state of an entity of a system. It happens at a certain point, the changes of the state of the entity happen discontinuously in time, only at some points. Between two consecutive events the state of the system doesn't change.

Mixed simulation (continual – discreet) are introduced so the systems which hold processes and events can be modeled (simulated). The processes move continually while events lead to discontinuity in a behavior of the system. That is how the mixed simulation which integrates discontinuous and continuous is developed. That is done by implementing two types of events: 1.Time events which are generated by a mechanism the controls events. They can induce a momentary change of states of the continuous variable.

2. The events of the states which are activated by a mechanism shifting of time with a constant growth. They can activate events of a discreet part of a model. Known simulation languages for a mixed simulation are GASP and SLAM.

When selecting a simulation model it is most important for the model to be most simple, because of its development and for the simplicity of usage by the user.

IV. VALIDATION OF SIMULATION MODELS

Validation and verification are actions with which we examine how loyally and precisely one model represents a real system. They are different conceptually but in most cases they are simultaneously being done, that is it is said they are in a dynamic reversible tie.

Verification is referred as a checkup to see if the simulation program (computer code) is without mistakes and if it is consistent with the model (conception). Validation is referred as a checkup to see if the model is a precise representation of a real system. That is and interactive procedure in which the behavior of the model and the real system is compared until we get the exactness of the model.

The behavior of the model is compared to the behavior of a real system and the differences noticed can be used to correct the model.

During the creation of the model a lot of approximation of the real system is used (only the characteristics of the original are important). The most used approximations are:

- **Functional approximation** – nonlinear functions are approximated by linear functions which have to be most similar to the original area where the system will most probably work. If the system has to function in an area where the matching of the functions is small, the program needs to print a message of warning.

- **Proximity of distribution** – real possibilities of distributions is approximated by simple distributions (normal, exponential). The most extreme example is when a random variable is switched with a constant.

- **Proximity of independence** – model is simplified by presuming that the different components (described by random variables) are statistically independent.

- **Proximity of aggregation** – when we observe a few elements as a whole.

Types of aggregation:

- **Time aggregation** – interval of time, for example a day, is seen as a singular period (the entire event took place during the day; it is presumed that they happened at the same time). It is a characteristic of all discreet – time models.

- **Inter – sector aggregation** – more firms, manufacturing lines are observed as a whole.

- **Aggregation of additional resources** – When many additional sources are observed as one.

- **Approximation of stationary** – the fact that the parameters and other characteristics of a system are not changed in time makes things simpler. For some physical processes (astronomical occurrences) it can be a beginning approximation, but for political, economic, organizational and social systems it is unsustainable because the occurrences are of stationary nature.

The goal of the validation processes:

- To produce a model that represents a behavior of a real system and that is close enough to a real system for it to be used for experiments.

- To induce the reliability to an acceptable level so the model can be used for decision making. The process of validation can be seen as integral and irreplaceable part of the development of the model. Interactive comparison of the model and the real system is done with different test which can be subjective (participants are the one who know the system well) and objective (they use data about the behavior of the system which is being processed).
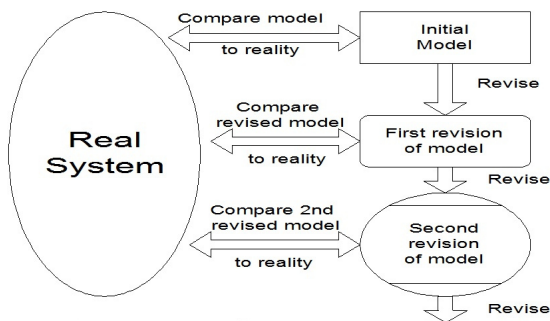

Figure 3 - Iterative process of calibrating a model

The practical access in the process of validation is summed in three phases:

- Building a model that is best represents the real system.

In the building of a model it is important for the users and the people who have little knowledge of the real system to participate. The analysis of sensitivity can be used to check its validity. (Testing on different input sizes).

- Confirming the premises of a model.

Two categories: premises of structure (the functioning of a system often includes simplifying and abstractions) and premises of data (the credibility of data and the correct statistic analysis:

1.identification of data distribution; 2.parametar estimation distribution; 3.validation of a statistical model through a test : z2, Kolmogorov – Smirnov test).

- A comparison (validation) input – output transformation of the models and the real system.

Most objective test of a model is a check the ability of the model to foresee future behavior of the real system.

Formal criterion for the establishment of the validity of a model:

Real system can be seen as a system on a higher lever and a model as system on a lower level.

Homomorphism (gr. homo – alike, morph – structure) is a formal criterion for determining the validity of a model for the given experimental conditions. For the simplicity of the presentation we will only speak of proving the validity of discreet time models.
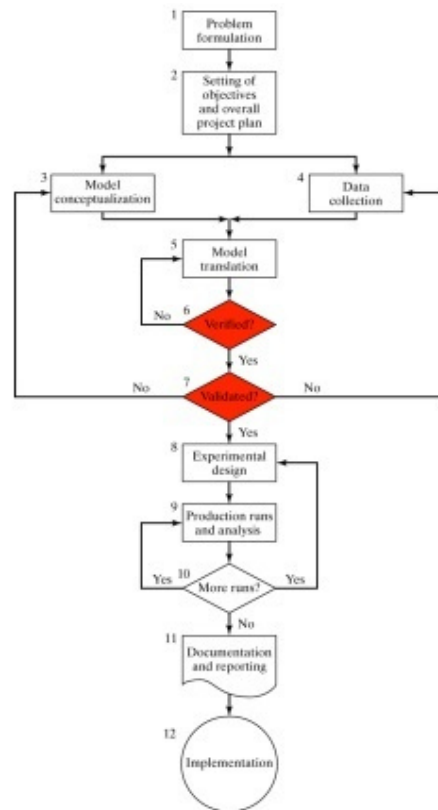

Figure 4.   Validation process

The essence of the formal procedure for the checking of the validity is to find the mirroring of the H with which it is possible that from every state the

basic of the model S, passes into a suitable state of the simplified model S. If this kind of mirroring exists than it is concluded that the input – output behaviors from the main and simplified models are the same for the given experimental conditions.

V. CONCLUSION

Knowledge acquired during the simulation may serve to improve the system under test and can be reached by information about which are the most important variables that affect the system. It can also be used for pedagogical purposes and for the experimenting and verifying analytical solutions. Once built model can be used several times. Simulation methods can be used to assist in the analysis.

Simulation is sometimes only way for solving the problems that are inaccessible to mathematical modeling. In fact, it is the structure of solving real problems using simulation modeling.

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Importance of Realistic Mobility Software Models for VANETs Simulations

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Abstract - Vehicular ad-hoc networks (VANETs) are subclass of mobile ad-hoc networks (MANETs) and they have been the most promising research field and development for the last few years. VANETs use vehicles as mobile nodes to provide communication among nearby vehicles and between vehicles and nearby roadside equipment. Due to several constraints such as real-traffic environment, logistic and considerably cost of implementing and deploying in real world, most research in VANET relies on simulations. A key component for VANET simulations is a vehicular mobility models. Such models represent the movement of vehicles and provide information on how their velocity, acceleration and location change over time. The quality of VANET simulations strongly depends on the degree of reality of the vehicular mobility model. This work shows that the realistic mobility models can significantly affect the simulation results in VANET networks. In addition, comparison of the various vehicular realistic mobility models and traffic generators are described from their pros and cons.

I. INTRODUCTION

VANETs are wireless networks that support cooperative driving among a large number of dynamically moving communicating vehicles (or nodes) on the roads. Communication between vehicles has taken place to establish the ad-hoc network. Vehicles forming highly dynamic vehicular networks together with other nearby vehicles, or with nearby roadside equipment. According to [1] there are four dedicated communication types in VANET: in-vehicle, Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I) and vehicle-to-broadband cloud. Such networks comprise of sensors and On Board Units (OBU) installed in the car as well as Road Side Units (RSU) [2]. The data collected from the sensors on the vehicles can be displayed to the driver, sent to the RSU or even broadcasted to other vehicles depending on its nature and importance. VANETs have specific characteristics that distinguish them from typical MANETs. Vehicles are highly mobile and do not move at random. They are limited to known paths road topology while moving, often in a predictable manner or might have only predictable routes. If the road information is available, it is possible to predict the future position

of a vehicle or get information about various risk traffic events or accidents. Generally, IEEE 802.11p communication standard and belonging protocols have to consider specific conditions existing in VANETs - RF signal attenuation, effect of obstacle blocking signal propagation, constrained movement and distances, high velocity and various density determined by traffic demand that changes over time and space [3].

The development of realistic simulation in is one of the main current challenges in a VANET research domain. Developing vehicular applications and protocols usually requires experimental expensive testbeds. However, due to several constrains such as reproducibility, economic costs and lack of scalability, there is not yet a real large-scale vehicular network available as test scenario. Therefore, the simulation is one of the most often used methods for performance evaluation of VANETs. Simulation is an effective tool for the evaluation of protocols and architecture in VANETs, but it is important to use a realistic mobility model so that the evaluation results correctly indicate the real-world performance of the system. Additionally, the real-world simulations for VANETs require realistic network and mobility models. Generally, simulations can be run for large VANETs during a long time in randomly heterogeneous traffic scenarios (rural, urban, multiline highway...) and repeated when needed. When evaluating vehicular network solutions through simulation, the adopted mobility model plays a very important role in the reliability of the obtained results [4, 5].

The remainder of this paper organized as follows. Section II describes the basic concepts of realistic VANET simulation, while Section III focuses on EAs approach used for optimizing vehicular mobility models. Concluding remarks are given in the Section IV.
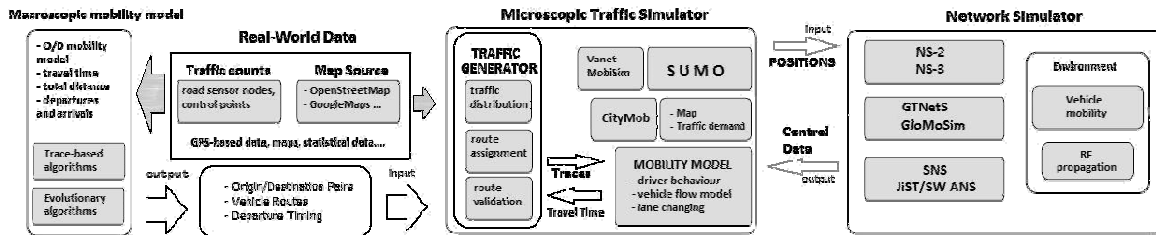
Figure 1. VANET simulation process and bidirectional coupling between microscopic traffic and network simulator

II. VANET SIMULATIONS PROCESS

VANET simulators provide both traffic flow simulation and network simulation. These two parts are dependent, because as vehicles move the network topology changes dynamically. Traffic mobility modelling is a very important task, because vehicular movement is strongly determined by the surrounding environment like road topology, traffic rules and density, other vehicles and it is additionally influenced by individual driver behaviour. Traffic mobility models can be classified into macroscopic, microscopic and mesoscopic. Macroscopic mobility models consider traffic flow, density and velocity of vehicles, total travel time, arrivals and departures of vehicles at a large scale. Microscopic approach considers the movement of each individual vehicle (acceleration/deceleration, line changing…), and mesoscopic models consider some interactions among vehicles at an individual level [6].

A proposed development of realistic VANET simulations consists of four steps, as depicted in Fig. 1. The first step includes gathering real-world data such as maps, traffic counts, statistical and GPS-based data that have influence on traffic. The obtained real-world data is then processed by a traffic generator (step two). Vehicular mobility generators are needed to increase the level of realism in VANET simulations and generate synthetic traces as an input to a traffic simulator. Synthetic vehicular traces are described with departure time, O/D (origin-destination) points, an exact route and a transportation mode. All that data can be useful to determine the traffic demand. The microscopic traffic simulators reproduce realistic vehicular mobility and moves vehicles in accordance to requested routes and traffic environment rules (step three). The finally step four includes network simulators that can be used to simulate the communication between vehicles in inter-vehicle communication systems. The main requirement for a network simulator is the accuracy of the simulated traffic data, in comparison to the real traffic generated in identical conditions. A VANET network simulator based on new vehicles

position update its own nodes positions and communications links in every time step. The data models used in the simulators such as NS-2 [7] or JiST/SWANS [8] rely on discrete event simulation, where different protocols of the network stack are executed based on the events triggered either by upper layer (application) or by lower layer (PHY or data-link). VANET network simulators perform detailed packet-level simulation of source, destinations, data traffic transmission, reception, route, links, and RF channels. Most recently used VANET network simulators aredeveloped for MANETs and require additional extensions (such as using the vehicular mobility generators) before they can be used to simulate vehicular networks.

The interactions between particular modules exist due for increasing the quality of simulations. Bidirectional coupling of the existing proposed network and traffic simulator creates a significate foundation that enable testing VANET applications in dynamic traffic scenarios. Separation of a traffic generator enables to test many applications for various scenarios. Traffic simulator-based mobility models based on microscopic traffic simulators [9]. It determines the movement of each vehicle at the microscopic level that can realistically simulate road infrastructure and interactions between vehicles. Interactions between particular elements present reciprocal impact and further increase the realism of a simulation. Traffic simulator can change vehicle routes as a result of VANET applications.

In the last few years, considerable progress has been achieved in the field of simulation tools and techniques helping to assess the performance of V2V and V2I communication protocols. Thus in contrast to early stages of VANETs research, there are now a substantial number of tools and models ready for use and openly available for the researchers [10, 11].

III REALISTIC VANETS SIMULATORS

The solutions presented in this section illustrate the importance of choosing a suitable traffic generator and mobility model for VANET network performances evaluation.

A. VANET traffic generators

We can make grouping the comparisons of the traffic generators into five different categories: software characteristics, maps types, mobility models support, traffic models implementation and trace formats support. Today, the real-world traces of individual vehicles are the most accurate representation of traffic behaviour. There is several simulation software environments exist, and they are capable of generating trace files reflecting vehicles movements.
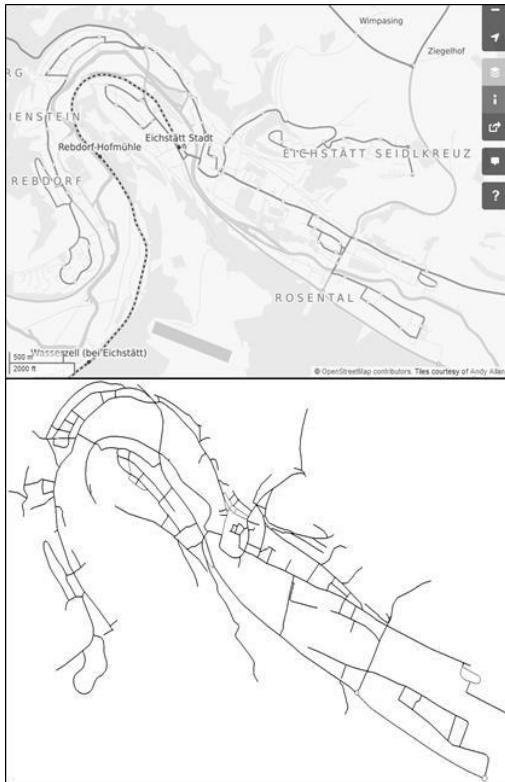

Figure 2. Screenshot of an OpenStreetMap view (top) and SUMO net file opened in SUMO GUI (bottom). It shows the map of the city Eichstätt.

SUMO (*Simulation of Urban MObility*) [12] is an open source, microscopic road traffic simulation software designed to handle large road networks. Its main features include: collision free vehicle movement, single-vehicle routing, dynamic routing, and multi-lane streets with lane changing, junction-based right-of-way rules and hierarchy of junction types. SUMO uses an openGL graphical user interface (GUI) and it can import many network formats. Furthermore, by combining SUMO and digitally maps from OpenStreetMap [13], we can simulate traffic in different locations (Fig. 2). We can retrieve and change values of a simulation step (vehicle, road or traffic lights states) through TraCI

(*Traffic Control Interface*) which allows bi-directional coupling with a network simulator.

MOVE (*MObility model generator for Vehicular networks*) [10] generates realistic mobility models for VANET simulations. MOVE is built on top of SUMO and it is integrated simulator. The output of MOVE is a mobility trace file that contains information of realistic vehicle movements which can be used by network simulation tools such as ns-2 or GloMoSim. MOVE provides a GUI that allows the user to quickly generate realistic simulation scenarios without the nuisance of writing simulation scripts as well as learning about the internal details of the simulator. MOVE doesn't need to install it, it just a MOVE.jar file and we can only use command *java -jar MOVE.jar* and the window of MOVE will open.

CityMob v.2 [14] is an ns-2 compatible mobility model generator. Vehicles will move with a random speed, within an user-defined range of values. Realistic Downtown Model (DM) model simulates semaphores at random positions with different delays. DM adds traffic density in a way similar to a real town, where traffic is not uniformly distributed. CityMob DM also has the capabilities of multiple lanes in both directions and vehicle queues due to traffic jams.

VanetMobiSim [15] is based on Java and can generate movement traces in different formats, supporting different simulation tools for mobile networks including ns-2, GloMoSim, and QualNet. This traffic generator focuses on vehicular mobility, and features realistic automotive motion models at both macroscopic and microscopic levels. VanetMobiSim can import maps from TIGER digital database (database of US geographic features) and adds support for multi-lane roads, separate directional flows, differentiated speed constraints and traffic signs at intersections. At the microscopic level, it supports mobility models such as IDM/IM (*Intelligent Driving Model with Intersection Management*) and supports realistic V2V and V2I interactions.

The preparation of the VANET traffic generator has to be as simple as possible. Its starting point should be a graphical interface that allows users to easily define the required parameters. However, most existing tools require a considerable level of expertise in order to use them appropriately. There is no mobility generator that can fulfill all the desired capabilities needed by the researchers. CityMob is good in software features and traffic model support. SUMO and VanetMobiSim have good software features and traffic model support. MOVE offers the user a great range of configuration

options, especially for the mobility simulation, making this operation complex for users not familiar with the tool (see Fig. 3). According to [16], only VanetMobiSim provides excellent trace support.
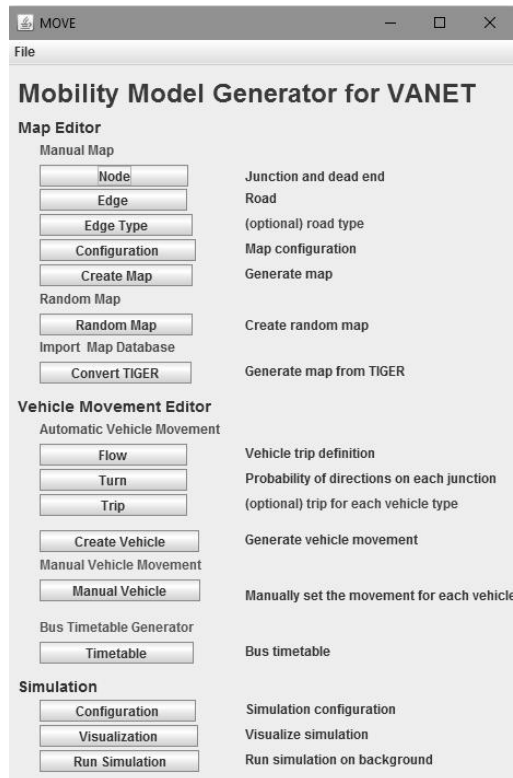

Figure 3. Configuration options for MOVE traffic generator

B. VANET network simulators

The VANET network simulators perform the data interchanges of the vehicular network nodes and evaluate feasibility and impact of vehicular applications. The specified network performance can be evaluated under different traffic conditions. They can also test the efficiency of routing protocols by calculating the ratio of successfully delivered messages and the delay time [17]. The network simulator needs to be both scalable in order to work with large networks and extensible to easily modify implementation details. Several network simulators can be used to simulate the communication between vehicles.

The Network Simulator 2 (ns-2) is a discrete event network simulator and includes: node mobility, a realistic physical layer with a radio propagation model, radio network interfaces, and the IEEE 802.11 MAC (*Medium Access Control*) protocol [18]. This simulator had some significant shortcomings both in the overall architecture and the modeling details of the IEEE 802.11 MAC and PHY modules. The ns-3 is a more scalable and easier to

use successor of an open-source network simulator ns-2. It facilitates the creation of ad hoc wireless networks and simulation of radio propagation fading. This simulator includes a significant enhancement in device and channel models or an implementation of various vehicular mobility models. The ns-3 is the most flexible and forward-looking tool to be incorporated in VANET simulation platform [19].

GloMoSim (*Global Mobile Information System Simulator*) is used for scalable real-time network simulations for large wired and wireless communication networks [20]. It is a discrete event simulator with the capability of parallel event processing. GloMoSim architecture is based on a multilayer stack model and gives an ease to users to implement different protocols at each layer and evaluate their performance separately. This simulator has extensible modular library for different network models including vehicular mobility models.

OMNeT++ [21] is classified as a modular discrete event network simulator. It is open source software that provides a platform for modeling wired and wireless communication networks. One of the key features of OMNeT++ is that it gives the ability to combine small building blocks of a network by using the advantage of its modular structure. Modules are connected by gates which resembles communication links between layers of communication stack. Simulation executions are easily configured via initialization files (.ini files) that are configured prior to the simulation run. OMNeT++ interface provides graphical as well as animated structure to demonstrate real-time simulation environment.

JiST is a high performance discrete event simulation engine that runs over a standard Java virtual machine. On top of JiST, a discrete event simulator engine called SWANS (*Scalable Wireless Ad-Hoc Network Simulator*) is structured to provide different environment models and communication protocols [8]. JiST/SWANS provide a built-in mechanism to support traffic generation as well as network simulation capabilities. It also gives a support to adopt various mobility models needed for realistic simulation.\

OPtimised Network (OPNET) Modeler is a discrete event simulator which can be used for designing the simulation and testbeds for different wireless communication networks [22]. OPNET is based on C++ programming language while it has different networking modules which can be used to create a network. It defines a network model as a combination of a different sub models consisting of

subnetwork for nodes by employing a hierarchical modeling. A large number of standard protocol models are available in OPNET Modeler and users can also create and implement their own models by writing C++ scripts. OPNET Modeler has an attractive GUI which can be used for model creation, running simulation and analyzing the results.

The election of the network simulator settings has a direct impact on the evaluation results. Some of the key features under which a network simulator is evaluated as a reliable, efficient and scalable simulator are: availability of well-known protocols in their library, graphical visualization, softens of use in context of scripting/programming, memory requirement and available documentation.

C. Realistic VANET simulators principles

Historically, a different mobility models have developed: based on random node movement, real-world or artificial mobility traces and bidirectional coupled simulators. Thus, a very heavyweight, bandwidth-consuming data exchange protocol may be successfully validated in a rural, sparse scenario, although it could have been found unsuitable in a crowded downtown traffic scenario.

In the early days of ad hoc network research, random waypoint mobility model was used for vehicle move randomly without any restriction. This model provides different results from more sophisticated vehicular mobility models. In real-world vehicle tracing models pre-recorded realistic mobility traces are used to creating a model. Real-world mobility traces give more realistic vehicle simulation and able to reflect one particular situation observed during measurements. On the contrary, synthetic traces can be parameterized, so may present different traffic scenarios. Synthetic traces have the advantage of providing simulations with very realistic mobility traces while freely adjusting the mobility parameters at same time so that influence of parameter can be examine on output. For the purpose of an accident information or hazard road conditions, intensive cooperation between network simulator and road traffic simulator must be established. This type of simulator has recently been developed.

TABLE I: OVERVIEW OF VANET MOBILITY MODELS

Mobility Model Class	Integrated Framework Support	Advantages	Drawbacks
Random movement	Virtually all	Intuitive and readily available	Imprecise and unstable
Real-world traces	ns-2, ns-3, GloMosim, Omnet++, OPNET, JiST/SWANS	Most realistic node movement, reusable traces	Costly, time consuming, no free parametarizat ion
Synthetic mobility traces-microscopic	ns-2, ns-3, GloMosim, Omnet++, OPNET, JiST/SWANS	Realistic node movement, free parameterizatio n	No feedback on driver behaviour
Bidirectionally coupled simulators	ns-2, ns-3, Omnet++, JiST/SWANS	Feedback on driver behaviour, free parameterizatio n	No reusable traces

All the models are summarized in Table I. One important aspect in a simulation model is the human aspects of driving preferences. These preferences should be included in car interaction models (car following, lane changing etc.) used by traffic simulators. Implementation of human imperfection allows the emergence of unpredictable situations, like collisions or traffic jams [23].

There is an overmuch of simulation tools that may be used to perform an experimental validation of a VANET traffic scenario. It may be seen that there have been several different combinations of tools in the evaluation of different proposals (see Table I). It is important to note that not every tool provides with the same functionality at the same extent. As we can see in this section, network simulators are particularly useful to test new networking VANET protocols or to propose modifications to existing ones.

The major concern of VANET simulation models is the lack of standardization in evaluation of protocols and traffic systems. In order to obtain reliable VANET simulations it is then necessary to reproduce the most accurate traffic mobility. A common set of parameters for tested scenarios and the evaluation metrics to compare simulation results would be highly desirable. A validated, high-quality and flexible VANET mobility model and simulation platform is necessary to support the real implementation of working VANET systems.

In this section, the most relevant simulation tools that are currently used are presented. Afterwards, their main drawbacks are identified. For the purpose of this work, only the most prominent features of these tools are presented. Interested readers may refer to [24, 25, and 26] to get further information.

IV.   TRENDS AND CONCLUSIONS

This paper presented that realistic VANET simulations is one of the biggest challenges in a VANETs research field. We have underlined the need of realism in every aspect of simulation in order to obtain reliable results. Simulation analysis using realistic mobility model for VANET environment show that the performance of the protocol is greatly affected by the mobility model. Among the traffic simulators discussed, it is concluded that SUMO provides most of the realistic mobility features required for modeling traffic patterns in urban as well as highway scenarios. The paper emphasizes that a combination of SUMO and OMNeT++ is an efficient way of simulating a vehicular communication scenario that includes most of the standard implementation protocol in the network stack.

In this work we can conclude that bidirectional coupled VANET simulation have advantage over the uncoupled simulation. Among the network simulators studied, ns-2 and ns-3 exhibit good software support. One of the major improvements in ns-3 is that it can implement most of IEEE 802.11 standards and can model the network scenarios closer to the real world.

Since microscopic simulators demonstrated their utility in the VANET applications design process, the increase of tool performance, scalability, and flexibility will be subjects to future research work. The paper indicated that the future direction in development of VANET simulations can be encouraged by the modelling drivers' behaviours and their needs. An implementation of driver behaviours and reactions to the VANET mobility models allows better evaluation of the impact of VANET applications on traffic systems.

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Educational Software as a Simulation Technique – Exaples in Teaching Technical and IT Education

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Abstract – Both the research of the simulation's representation in teaching and the effectiveness of the educational computer software in teaching have been presented in this work.

I. INTRODUCTION

Today, the life and work are unimaginable without computers. The computers are everywhere. They are all around us: in the houses, at schools, in the production, etc. The computers are made to solve people's problems, make some things easier, save people's time.

Methodology of teaching technical and IT education represents clear ways and methods of teaching and studying which are planned and organized and which are directed towards the realization of the basic educational and functional teaching tasks. Teaching TIT (Technical and IT education) is first of all both theoretical and practical. The connection between theory and practice is the unity of theoretical contents and workshop and laboratory's exercises. The practical work gives the opportunity both to form some skills and habits and to apply the knowledge in practice. During the practical work students get some skills such as handling tools, fixtures, machines and they also learn to make a proper selection of materials that will be used. According this, during the teaching, there must be some strictly defined rules which explain how and under what conditions certain tasks can be solved.

Learning by model enables identification with the original to set aside an important feature of the complex processes or devices. This work is about educational computer software in teaching technical and IT education. There is a short description of computer simulation, a computer simulation's classification and simulation's techniques in teaching TIT (Technical and IT education) in a theoretical part of this work. The other part is about a drawing example in the software program Adobe Director, which is shown as a simulation's technique. This simulation can be used in teaching TIT as an aid in studying teaching subject "The Introduction mechanical engineering".

II. COMPUTER'S SIMULATION

A. The simulation – the concept and definition

Some changes in a certain time period can be traced by simulation, and a model is mostly a static state of the system. The program, the product and the state's history enable the simulation.

The simulation's model is a computer's model which is conducted by coding. The simulation takes care of the success of doing the model's instructions by computer. If the program realizes the model successfully, the program is correct [1].

There is often a question why one system (a simulation system) is replaced by a model first and then the simulation is done. There are many reasons for that, but the most important are following ones:

- The experiment over the real system can be expensive or even impossible (for example, in economic systems or in chemical factories)

- When there is no analytical solution for an analytical model (for example, more complex models of mass service)

- when the system is too complex to be described analytically (for example by system of differential equations) [2].

B. The classification of computer's simulations

New computers are multiprocessors. They can do some parallel processes at the same time. They have fast memories and graphics cards, which enable process which is being monitored. However, a computer as a „machine", is nothing if it hasn't got

an adequate program for processing and monitoring. On the other side, there can be a failure during the monitoring, processing and even attempting to apply some scientific experiments which are pretty normal, but those attempts can be also dangerous for scientists and experts, and depending on the place and the way of doing the experiment, they can be dangerous even for the people and the environment. That's why the concepts of model and simulation have been introduced recently.

Using simulation in teaching or teaching using computer's simulations is more convenient in natural and especially technical disciplines, where there is a possibility of process's visualization. Therefore, there are large possibilities for applying both models and simulations in teaching TIT. The basic feature of computer's simulation is molding by using some mathematical devices, some logical rules or natural laws.

From the student's aspect, the computer's simulation in teaching TIT enables two-way information's transmission, because the student can manipulative with the input and output units of the model by himself. In that way, the research student's function becomes more important. It is obviously very useful, too, but the simulation shouldn't replace completely the experimental, laboratory and practical work in teaching. In certain conditions, when there are no possibilities for a quality laboratory work at school, or experimental work in real circumstances, the simulation reasonably can be used instead of experiments because much more funding is needed for many instruments than for using computers.

II. EDUCATIONAL COMPUTER SOFTWARE AS A SIMULATION TECHNIQUE

Digitally simulated activity is a useful way to develop some new skills at students. In the world of technology, the simulation has already been very well-know-the obvious example is mass industry of computer games. However, the games are not the real world. The authentic studying is always the best way of studying, but there are some alternatives when the authentic studying is dangerous or expensive.

There is an example in Midkent College in Gillingham, which has bought a simulation of welding, to teach students some metal's welding techniques. Debra Willson, a program manager in engineering who brought the software in Midkent, was a first person who saw that it was shown as good on skills in London last year. It was produced by Lincoln electricity in CAD, and firstly it was projected for teaching welding to American marines.

Debra estimates that a less number of new students use welding is simulation every year, and that the most students use it repeatedly. The students of Electrical Engineering, art and design can use it as a part of their course after they learned the welding's techniques.

The teachers and educators think that the simulator is a big progress. With no additional time required and costs. Using the simulation's software programs has made some changes regarding to the teachers' time wasting, but the number of the lesson hasn't been changed at all. It is much easier to the teachers to give the feedback, and as a result of that the students pass their exams more successfully.

III. GEAR'S WORK SIMULATION

The simulation is presented in Adobe Director. If you click the button „next", you go to the following window which gives you two options: theory and simulation.

Figure 1. The simulation's title

Then, if you click the button "Theory", you go into the next which explains briefly what the gears are and what their shapes are.
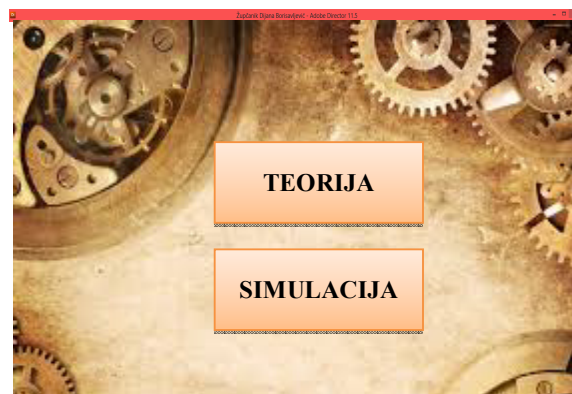

Figure 2. The range of options

Choosing the option „Theory" students can read a little bit about gears, so they can understand the things they will learn about.

Figure 3. The Theory's display

Pictures 4, 5 and 6 show the examples of gears' shapes, so the students can easily recognize each shape, which can make solving the problems connecting much easier. If you click the button „next", you go into the following theory's picture.
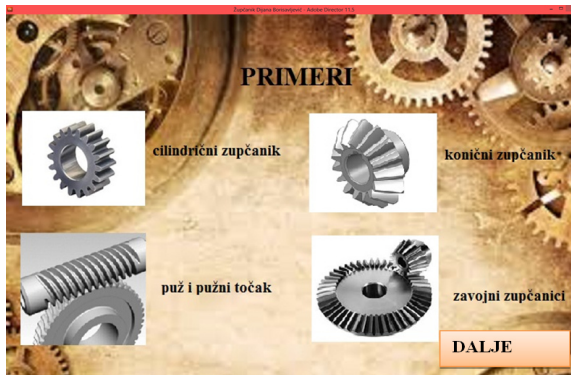

Figure 4. The gear's examples

Figure 5.   The gear's examples

Figure 6. The gear's examples

Adobe Director's effectiveness is in the fact that it allows insertion of different contents on the page (audio/video materials, photos). There are a few parts in the simulation. There is a gear's simulation in the middle, and then there are some push buttons which the students use to match the gears according to their shapes. There's also a push button both to check and to cancel. There is a field with a simulation's task (picture number 7). Using this simulation the students have to learn which shapes are matching. The students have to use the push button according the shapes and match them with the appropriate picture, so in that way they will match the gears according to the given shapes.

Figure 7. The simulation's home page

If the student doesn't know which gears can be matched and if he makes a mistake matching the wrong ones, he pushes the push button "check". Then, the red square appears and it shows that those gears' shapes can't be matched (picture number 8).

Figure 8. Incorrectly matched shapes

If the student matches the gears' shapes correctly, he pushes the push button „check". Then the red rectangle appears which shows that it is possible to match those gears (picture number 9). After that, the gear's work simulation starts to work and it shows that the gear's moving can start.

Figure 9. The appropriate gear's shapes

If the student tried to match the gears' shapes and he didn't make it, he could continue by clicking on the appropriate button – shapes – and in that way the buttons start working and moving. There is a push button which cancels all the chosen shapes by that time, so the student can't start to match the gears shapes again.

IV. CONCLUSION

The research's conclusion is that some pretty good results are achieved using the simulation's software „gears" teaching TIT (Technical and IT education).

The Computer simulation's usage has an important role in education, especially in teaching TIT. It is necessary to use all the advantages of this simulation to make the students be interested in the studying process and also to prepare them for some bigger tasks in the future. It is clear that using the computer's simulation in teaching TIT leads to the improvement and efficiency of teaching, by confirming the hypotheses and two sub-hypotheses.

The computer technology's development allowed the modeling and simulation's development in all scientific, technological and especially educational disciplines. The possibilities of solving problems which can be simulated are expanded by increasing speeds, capabilities and memory capacity of the computer.

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TEACHERS' PROFESSIONAL TRAINING

Informatics Teachers Professional Competences

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Abstract – As the digital technology is becoming one of the essential parts of modern society, the importance of informatics teachers is being highlighted. As teachers play a vital role in forming student's professional and social skills and knowledge, it is essential to define the set of competences that they must master. As such, we defined the three aspects of informatics teacher professional competences: programme, pedagogical and communicative.

I. INTRODUCTION

The professional teacher practice is the educational component with complex goals: to direct and to lead the development of students' competences, and to provide the harmonization of various aspects of students' personality. The basic goal of teachers' profession is to direct the development of students by educating them [1], so that they become:

- Versatile and creative;
- Skilled and educated;
- Intellectually independent;
- Productive;
- Emotionally stable; and
- Socially integrated.

In order to achieve the demands, educational goals, and to success professionally, teacher must be competent. Teacher professional competences are the acquired knowledge, skills and developed abilities that enable to meet the work demands (to realize the professional role). Teacher competence is complex concept with integrated three parts:

- Programme competences represents the system of knowledge and skills based on the content of the subject (knowledge about content, structure and scientific specifics that the subject is based on) and the development of abilities that provide teachers with tools to achieve its educational purpose in specific domain (the transfer of knowledge and skills based on the content);
- Pedagogical competences are the system of knowledge, skills, abilities, and motivational dispositions that provide teachers with the tools to achieve their educational roles in its narrower mean – to provide the adequate pedagogical interaction, shape the educational content and to lead students' learning process with the adequate means;
- Communicative competences are the system of knowledge, skills, abilities, and motivational dispositions that provide that teachers successfully achieve the goals of communication and teaching as social interaction.

Informatics teachers should possess the knowledge, skills and developed abilities (according to the new concept of teacher professional activities preparation) that will enable them to implement the following activities:

- Planning, implementation and the evaluation of teaching and professional practice (based on the subject curriculum, goals and outcomes; evaluation strategies; age and other student characteristics; specific professional and methodical skills);
- Monitoring the students' development and achievements (based on the psychological characteristics, ways of applying the principle of individualization, educational models, cooperative strategies, adequate family functioning, as well as developed professional skills);
- Cooperation with other school stakeholders and social environment (with colleagues, student families, community, based on the group and family functioning, social processes and relationships, teamwork and cooperation, culture and tradition, as well as professional social and communication skills);
- Keeping pedagogical documentation;
- Continuous training and professional promotion.

School subjects in the field of information technologies are pedagogically designed in accordance with the basic goal to ensure the adoption of informatics literacy and the development of students' technical culture.

Considering that the informatics literacy reflects the connection between technical literacy (as computer science is in the field of technical sciences) and the elements of mathematical literacy, the informatics educational content in the current curricula is the integral part of the Informatics and computer science primary school subject from 5th to 8th grade and the Computer science and informatics subject in the Secondary Education.

The expansion of the IT area has caused the incorporation of IT knowledge in various scientific disciplines, and the development of a large number of subjects in the field of informatics that are either autonomous, or form the core of a particular production area in which the IT developments are implemented.

Specific teacher competences in the field of informatics are: the use of information technology as a content and as a teaching technology, providing the computer mediated learning environment, etc.

Two basic informatics teacher tasks are:

- The development of students' informatics literacy, and

- The development of skills to apply functionally the information technology in learning process and the future practice.

The elementary knowledge on information technologies and the IT skills are taught within the primary education elective course named *From toys to computers* from 1st to 4th grade, and the optional subject named *Informatics and computer science* from 5th to 8th grade. Therefore, the teacher competences are framed within the field of informatics.

II. COMPETENCES AND THE INFORMATION LITERACY

Competences represent the proficiency teacher show in what has been learned in real-life application of a variety of situations. This is done in an appropriate and effective manner, whether in school or other environment. Competences imply that teacher is able to identify, name, and understand the problem or task in real-time, and to design, plan, and realize the solution or answer. They are not inherited and are not innate, but gradually acquired, built and developed in learning process through the direct experience. Usually, the development is done by assessing situations, planning procedures, taking concrete actions and activities, thinking about the validity of the adopted assessment and undertaken activities (reflection) and critical review of the main aspects of the situation, ways of solving problems and steps that were taken. Competences enable

teachers to take the actions based on knowledge, values and attitudes that were built and developed during their education. The integrative role is reflected in combining knowledge, skills, behaviors, attitudes and values.

The informatics literacy is an essential prerequisite for broader information literacy. The informatics (computer) literacy involves a number of technical skills and knowledge that are needed for using computers (computer systems, networks and applications) to find, store, evaluate, create, present and exchange the information, as well as to communicate and cooperate in an online environment.

The information literacy recognizes the need for information and the possession of knowledge about how to find, evaluate and use the best and latest information that is available to solve a specific problem or make any decision [2]. The sources of information are various: Internet, computers, TV, books, magazines, movies, etc.

The introduction of information literacy in education refers to training students, citizens and workforce to adopt new technologies, and the development of social development and the improvement of economic productivity [3]. Teachers should be aware of these goals and able to see the values of components that determine these targets. The elementary literacy should include improving it with the help of technology and adding the information literacy in the relevant context. The pedagogical practice should include the use of various technologies, tools and electronic content as a part of group or individual student activities. The teachers should possess the knowledge of when and where to use the technology for the realization of educational activities.

The early stage of teacher competence development related to the information literacy should provide them with the knowledge and skills to perform the selection of appropriate educational software, content and technology that fits the goals of the curriculum and teaching methodology. Teacher competence must include the ability to manage information and support collaborative projects. Teachers should also be trained to use ICT to create and monitor individual and group student projects as well as to collaborate with other teachers and experts. Teachers who demonstrate competence in content creation will be able to design ICT-based resources and environment for learning and to use ICT to support the development of knowledge and students critical thinking skills in continuous and reflective learning [4].

III. INFORMATICS TEACHER COMPETENCES

The importance of competence is widely recognized. The EU institutions recommended the member countries to lead educational policy that supports the development of competences some 15 years ago [5]. The main interest was in the development of so-called key competences, which are the backbone of lifelong learning and have great importance for the organization of teaching and learning in the classroom.

The defined key competences include communication in native language, communication in foreign languages, mathematical competence, and basic competences in science and technology, digital competence, learning to learn, social and civic competences. Starting from this list, each educational system defined and developed the list of competences in respond to its concrete needs and priorities.

The recent documents emphasize some of the key competences as transversal competences [6]. Among transversal competences are learning to learn, communication skills, initiative and entrepreneurship, digital competence (including media literacy), cultural awareness and expression. These competences combined with training in information and digital technology training should be incorporated in the national curriculum, pedagogical practice, and teacher expertise.

The following list of teacher competences are defined and adopted by the Serbian legislature in 2013 [7]:

- Working with data and information: In order to understand the events and make an informed decision teacher knows that it is necessary to have relevant and reliable information; Teacher can compare different sources and methods to obtain information, evaluate reliability, and identify possible causes of errors; Use tabular and graphical data representation and is able to read, interpret and apply the displayed data; Use IT to store, present and process data; Knows the difference between data and their interpretation, and that the same data depending of context may be bias interpreted; Understand the difference between public and private information, and apply the basic rules of privacy.

- Digital competence: Search, evaluate the relevance and reliability, analyze and systematize information in electronic form

using appropriate ICT (devices, software and e-services); Express in electronic form using appropriate ICT including multimedia and the expression with the elements of formally defined notations (e.g. addresses, queries, commands, procedures etc.); Present, organize, structure and format information in an efficient manner using ICT resources; Solve problems with the appropriate ICT, and its capability; Use ICT efficiently for cooperation and communication; Identifies risks and dangers of ICT use and acts responsibly in relation.

IV. CONCLUSION

Informatics teacher should know how to relate ICT with other subjects and to frame its use in a multidisciplinary context. Teachers who teach one discipline should be able to relate its content to relevant content in other disciplines (inter-disciplinarily) or in disciplines such as mathematics or languages (multi-disciplinarily). ICTs by their nature involve various disciplines: so the teacher should be able to search for explanations involving the single discipline and at same period it in a multidisciplinary scenario. Therefore, an informatics teacher-training program should offer students the knowledge and awareness of the relationships between various disciplines. This competence cannot be accomplished in the framework of a strict disciplinary-separate training program. Furthermore, prospective teachers should be provided with instruction that facilitates the identification and development of concepts that unify the traditional science disciplines. Specific learning opportunities and instruction that would help prospective teachers to develop such interrelationships should be included in such training.

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EDUCATION MANAGEMENT

Communication and Change Management in School

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Abstract - The paper presents the results of research relating to the determination of the basic factors that influence the acceptance and application of innovation and change, and communication in the school, in order to improve educational work. The aim is to identify the attitudes and opinions of teachers on communication and changes in the school, the difficulties encountered in acceptance such changes. Changes in school are necessary because they are expected to monitor social change. Innovation in school can be varied, ranging from the goals and tasks, through teaching methods, forms and means, and then the content of textbooks, use of literature and educational roles. Therefore, it is important to properly accept the changes, and establish good communication.

I. Introduction

Communication is one of the most important tools that the leaders of collectives, directors may influence the success of their work. It touches every area of business at the school, including the interaction with students, parents, colleagues, superiors. Good communication contributes to the style of management in which people feel comfortable and motivated to work. Any improvement of communication also means the possibility of improving interpersonal relationships. Poor communication is the cause of many problems. Communication as an exchange of ideas and information from one person to another, including the sender and recipient ideas [1].

Communication is becoming more present and inevitable, even when is silent. Communication is a fundamental and universal human activity. With every act, man sends a message, even without his knowledge or intent. The messages we convey is not only words but also gestures, facial expressions, clothing, organization, time, and even scents. Various forms of non-verbal communication are often beyond our control and may significantly affect our credibility [1] .

Individual patterns of human behavior are determined by the communication skills of each individual part receives at birth, a part of them learn through life and education in the family, in school education and practical knowledge acquired through work and communicate with others [2].

The key to good communication is the exchange of information and ideas in which not only active shipper who delivers the message. All parties must work together to effect the giving and receiving of information. During the transfer of messages and operate two elements to the content and context. The content of the actual words or symbols of the message which we call language - spoken or written words combined into sentences that are grammatical sense. The context of the situation in which a message is transmitted, as well as the manner in which the transfers. Also called paralanguage - nonverbal elements in speech such as tone of voice, look, body language, gestures, facial expression, personal space, emotions that can be seen. Paralanguage is often the cause of that message is misunderstood because we believe that we see more than what we hear. All communication exchange starting from the content, content, is transmitted in a time in which the process employed to develop interaction between the speakers. Transfer content presupposes the creation of meaning based on the same elements of communication [1]. Communication is a process that makes something common, interconnection to the community and impart men among themselves. We can still be defined as a process of mutual exchange of meaning.

Interaction means joint action, interaction, is an integral part of the communication, because actually a message can not be sent without the cooperation [3].

II. RESEARCH METHODOLOGY

A. Aims and objectives of research

The aim of the research is to determine the condition and attitude of teachers towards teaching innovation, ie. the ratio of teachers to changes that occur in the school, their involvement and interference in the training.

General tasks of research:

1. Identify the attitudes and opinions of teachers of communication in school;

2. To examine the opinions and attitudes of teachers about the changes in the school and education;

3. Examine the motives of teachers for the implementation of innovation and change.

B. Research hypotheses

H1 – Teachers express positive attitudes and opinions about communication in school

H2 – Teachers express positive attitudes and opinions about changes in school education

H3 – Teachers apply innovation in teaching to achieve better results with their pupils

C. Research methods

We used the method of theoretical analysis and procedure of content analysis and descriptive methods. After analyzing the available literature and drafting instruments, we started the survey, followed by an analysis of the data obtained and finally interpretation of results and conclusions. After we examined the available similar research we created the survey or questionnaire. To test the attitudes and opinions of teachers we used the survey.

D. Sample survey

The research sample consists of 37 teachers from the elementary school "Žika Popović" municipality Vladimirci.

III. RESEARCH RESULTS

1. The attitudes and opinions of teachers of communication in school

Question number one that was asked in the survey to teachers if the teacher is satisfied with communication with colleagues, refers to the communication in the school. Of the 37 teachers who answered the questions in the survey, 18 teachers are satisfied with communication with their colleagues, while 12 were not satisfied with the communication, a 7 is partially satisfied.

This number tells us that the majority of teachers in a school that has a happy communication with colleagues, this section refers to formal communication, where we have previously explained the meaning of each question teachers. Dissatisfied 32% of teachers, and partly satisfied or dissatisfied 19%, we can consider that teachers are reluctant to provide an answer "partially".

Already the first question, we can confirm our hypothesis and say that teachers are satisfied with their communication with colleagues in the school.

Question number two, relating to communication with superiors. Of the 37 teachers, 11 responded that they are satisfied with the communication with superiors, 8 are not satisfied, while 18 teachers are partially satisfied. Teachers are partially satisfied, however, the greater the percentage of teachers satisfied 30% of the teachers who are not satisfied with the communication (21%).

Question number three was whether teachers are generally satisfied with communication at the school that takes place, and applies to all other communication with colleagues, which is not related to the business and cooperation at this level. Most of the teachers (21), is happy with communication with colleagues that is not job-related. This percentage in relation to the percentage of teachers who are satisfied with a formal communication tells us that teachers get along better in communication that is not related to work or school. Disgruntled teachers is 10, a partially satisfied teachers is 5.

One of the important questions of the survey, is question number forur that describes teamwork. Teachers (nine of them) believes that teamwork is bad, while ten of them believes that teamwork is good, and that's not bad, while 18 of them partially considered poor teamwork. This response may in part be related to teachers are unhappy with the team work in some situations, while in long teamwork work better and are thus given the answer "partially". This question shows that teachers are still satisfied with teamwork, but to a lesser extent, are satisfied teamwork in relation to the percentage indicating that they are satisfied with the formal communication.

Question number five - are happy to share ideas, teaching materials and equipment with their peers, teachers who like to exchange ideas, materials and equipment did twenty of them, while the two of them does not like to share. 15 of them as explained in the interview that in some situations, share their ideas and materials, equipment, and in some situations do not like to share because with some colleagues have a better relationship with some experience but have worse avoid such cooperation.

Question number 6, ie. answers to this question tells you how many teachers are ready to initiate and to accept the initiative of their colleagues, who can contribute to the progress of the school and the pupils. This question refers to any positive initiative, ie. at the initiative of bringing a positive outcome. 17 of them says that they like to initiate and take the initiative, only two teachers do not accept the initiative and do not like to initiate, while 18 answered this question with the answer „patly". 36% of them prefer to initiate and take the initiative.

On the question number seven, do you regularly informed colleagues about school activities that can improve cooperation, 14 of them responded 'yes'. The largest number of responses given by teachers who are partially informed (54%). This answer applies to teachers who rarely inform their colleagues, or a situation arises that convey information for activities that promote school.

Teachers who participate in the work of teams on this question with "yes", but there are only 15, while 17 of them partially participate or participate once and sometimes not. Five of them does not participate. The percentage of teachers who participate (41%) assume that they are teachers who are satisfied with the work of the school team. We are not conditioned teachers who do not participate in the work of teams, not to answer the question whether they are satisfied with the work of the school team, so this is an assumption.

Question number nine - are you guided by the rules of successful communication, 22 of them responded positively, which means they are trying to communicate is successful, we do not have teachers who answered "no", which confirms that teachers significantly trying to make their communication is successful. 15 of them gave the answer "partially".

The results of our study indicate positive attitudes and opinions of teachers on communication in the school, which confirms our first hypothesis.

General statement by analyzing the percentage of the result would be that teachers are willing to cooperate and communicate with colleagues, or that cracks are also some experiences they restrained in communication means, because as we can see we had a lot of answers "partially", as they themselves expressed in completing surveys to teachers who are undecided in answering the question, in some situations they were on the side of the answer is "yes", and in some situations at the cellular response "no" so they could not specify the answer.

2.The attitudes and opinions of teachers about changes in school

The results of our study indicate positive attitudes and opinions of teachers towards the implementation of changes in practice. That is a positive attitude in the implementation of changes in the school. Which means that teachers are open to innovation and all changes that relate to better. School equipment is done to contribute to a greater openness to innovation, and so many factors of which depends on the changes. Further analysis of the results is shown in more detail the opinions of teachers.

For the sample of 37 teachers, we can conclude that there is a positive attitude to change. In the end it can be said that teachers have a positive attitude towards innovation, which means that our hypothesis number two is accepted.

One of the important things to note is that a positive attitude is not the only condition for innovation, and for accepting the changes. Since the resistance of teachers to changes may occur later in the paper, or in the stage of introduction and spread of these changes. This positive attitude is the basis, but not sufficient condition.

Question number one in this part of the questionnaire about changes and attitudes of teachers, shows that 25 teachers believe that changes are needed to improve education, but only 5 of them think that changes are needed to improve education. The answer "partly" to this question yielded 7 teachers.

On the question of the number eleven, whether the changes are introduced in accordance with the

plan, the teachers say in a number that changes are not introduced in accordance with the plan, which means that the deviations from the plan. Verbal exposition of this issue we have come to a more precise answer to the changes that are unpredictable in a number of cases when introducing changes happen any deviation from the plan for the introduction of these changes. What are the answers to this question confirmed.

Teachers, most of them accept the changes, while 15 of them this question gave the answer "partially". This answer are explained orally, most of them agreed with the statement that they accept the changes, but it happens that they do not agree entirely with the changes.

Ten of the teachers implemented the changes initiated by the master and motivate colleagues to these changes, a number of teachers 20 of them responded to this question with the answer "partially", which means that they do not fully implemented these changes initiated by superiors because some of the changes are not accepted completely.

Teachers who stabilizing effect change and control the effects of the change, 11 of them, this question was answered "Yes". The highest percentage answered "partially

What is important is that the changes have a positive impact on the overall work of the school, of course, change for the better, and innovation. With this statement agreed exceptionally large percentage of teachers who have given to this question in the affirmative answer. 62% of them agree that the changes have a positive impact on the work of the school. A small percentage of them (14%) think that the changes do not impact positively on the work of the school. While 24% of this question gave the answer "partially". Oral presentation, we get the information that this percentage believes that some changes have a positive impact and some do not, depending on the mode of implementation of changes, unbundled time as well as a number of factors that affect changes.

IV. CONCLUSION

Innovation is an important factor of internal reform school, a change in schools are necessary because of the school is expected to follow the social changes that people bring adversity and prosperity. It is important to know that the aspiration for change in education is not an invention only this time more or less present has always been and will be present in the future. It is the need of man and society.

If the manager or director of traffic on the leader first needs to win over teachers and to create the climate for collective change. The starting point of innovation management school and the changes that take place in school is to plan these changes in which must be included teachers. The school should have a long-term modernization plan which would result from the annual plan of pedagogical innovation, then plan for monitoring and evaluation of innovation, as well as the plan of professional development of teachers for the implementation of innovation, but also a system of evaluation and reward teachers who apply innovation [4].

Change management is not a task someone other than ourselves. Employees relate differently to change. Reliance, fear of the new is not created now, it is something long known. Hence work and look for models, methods, examples of which will be the motive, support the inclusion of all of us and our employees in change management.

The key elements of encouraging creativity and the willingness to change are the creation of an open, stimulating learning environment, in which the dominant values will be shaped around the bet that questioning and confrontation of different, dissenting ideas creates the most stimulating intellectual climate, as well as the possible relationship of cooperation with political opponents. Pluralistic educational context of developing the idea of a world of differences, changes and uncertainties as well as the view that it is precisely this fact the best incentive for initiative, innovation and creativity of the individual, which are the basic assumptions of psychological readiness for change.

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IT PROJECT MANAGEMENT METHODOLOGIES

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Abstract – **Project management proved to be the reason of project success and it really makes the difference. Beside general project management many specific methodologies were developed during time, depending on project type. They are recognized as very important factors of project success and now they are subjects of study programs at technical faculties. In this paper several project management methodologies will be described, with special preview of concrete application of different methodologies in companies. The recommendation of the new methodologies is suggested as well, in order to improve project realization and accomplish its success.**

I. INTRODUCTION

The main purpose of this paper is to explain information technologies (IT) project management methodologies, its implementation in business that makes the difference and success, and to propose the new methodologies for IT project management. Because of the fact that IT project management methodologies are recognized as very important factors of project success, they are now subjects of study programs at technical faculties.

In this paper several project management methodologies are described, as well as real-world examples of its implementation. The recommendation of the new methodologies is suggested as well, in order to improve project realization and accomplish its success.

II. RELATED WORK

Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements. [1] Project manager should succeed in accomplishing project scope, time, costs and quality, but also in satisfying needs and expectations of project stakeholders. [2] There are many project management definitions and the standard ones, beside the previously mentioned, are:

- Project management is planning, tracking and control of all the project aspects and motivation of those included into project, in order to accomplish project goals on time, costs, quality and performance. (according to British standard Prince2 [3]);

- The project management includes all tasks required for planning and controlling the activities of the project team in order to safely achieve the objective of project and to early recognize and correct any problems. (according to German standard V-Modell-XT [4]);

Project methodology contains at least nine basic elements: roles, skills, activities, techniques, tools, teams, deliverables, standards, and quality measures. Different methodologies are, however, needed depending on the project size (number of people being coordinated), the criticality of the systems being created, and the priorities of the project. This all takes into account when deciding on correct methodology to use. Any comparison of methodologies should include these dimensions, and their relationship to the needs of the project or organization should be assessed. [5].

III. RESEARCH

As many industries use information technology and focus on the development of software, it is appropriate to describe the IT environment to explain why different methodologies are needed for different things. Every company currently without a project management framework needs to identify, select, tailor, or build one, before managing a project. Some structure is necessary. If management wants their company to be successful in a project-based world, they should start moving. [5]

A. PRINCE2 Project Framework

PRINCE2 is an acronym for Projects in Controlled Environments (second version) and is now the United Kingdom's de facto standard for IT project management. The Central Computing and Telecommunications Agency (CCTA) originally developed this structured project management methodology, which now forms part of the Office of Government Commerce (OCG) — a government agency — for the development and implementation of IT projects. In fact, this methodology is now so popular that many companies hire only PRINCE2-

certified project managers. More and more companies are moving toward adopting this as their standard project approach. Companies such as British Rail, Nat West, Hitachi, BT, London Underground, and Royal Mail, among many others, benefit from using PRINCE2. Figure 1 shows that PRINCE2 is a process-orientated approach for project management. Each process has its inputs and outputs with associated project tasks and activities to be carried out. The methodology shows us that a project is decomposed in manageable phases, allowing efficient command and control. For

example, look at project planning. This phase is mainly interested in focusing on results rather than planning when the activities will be done. PRINCE2 is largely driven by its business case (see templates), which describes the business justification, rationale, and motivation for the project. The same applies to all phases shown in the figure. Integrating this methodology into a company's existing culture and processes may require the insight and assessment by certified PRINCE2 project managers, who are knowledgeable of this methodology.
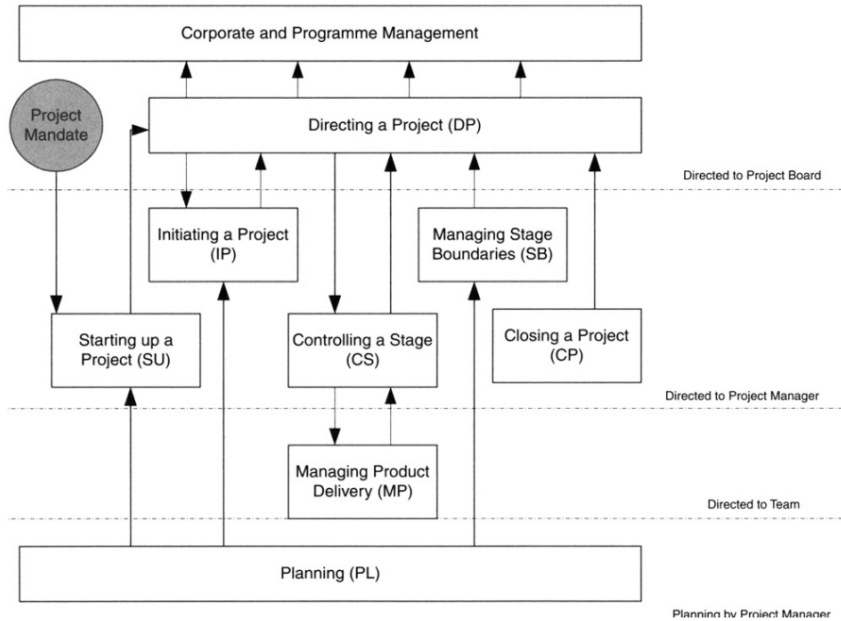

Figure 1: PRINCE2 life cycle.

Advantages of PRINCE2:

- The method is in the public domain, and services (training, consultancy, and tools) can be obtained from several independent suppliers.

- The method has active user groups in the United Kingdom and the Netherlands.

- The method is applicable to small and large mega-projects.

Disadvantages of PRINCE2

- It is a method and not a cure for any project. People who use PRINCE2 should continue to think.

- Human factor or soft issues are not within the scope of the methodology and are desperately needed for project success. [5]

B. Agile methodologies

Agile methodologies present new, nontraditional ways of building complex products and systems.

Projects that use agile methodologies are now starting to report improved time line and cost savings, compared to those in the heavyweight family. Agile methods have increasingly attracted interest in the Software Industry. [5]

A survey performed in the United Stated and Europe has shown that 14% of software companies are already using agile methods, and 49% of the companies which know something about agile methods are interested in adopting them. This increasing interest may be due to a belief that Agile Methods are powerful development alternatives, supposedly able to avoid project problems such as low productivity, schedule delays, high costs, lack of people motivation, and others, which still are significant problems in the Software Engineering field [6].

Industries that use agile methodologies include: financial, IT, telecom, utilities, and many more service industries. Furthermore, this trend is starting to emerge worldwide. The following are the most commonly used agile methodologies:

- Extreme Programming (XP), one of the new promising breeds of lightweight methodologies is the brainchild of Kent Beck. XP is one of the agile processes. XP embraces four core values that its project teams should follow: (1) communication, (2) feedback, (3) simplicity, and (4) courage. The focus of XP is to reduce development costs. Although XP is worthy of consideration as a development methodology, it should not be used on large projects. XP has been successfully used with Rational Corporation's RUP. This combination has been called the dX process and is also RUP-compliant (Martin, nd).

- Scrum: Scrum is a lightweight, agile methodology focusing on software development. Scrum's ultimate goal is to deliver as much quality software as possible within a series (three to eight) of short time boxes (fixed-time intervals) called sprints that typically end every 30 days. Each stage in the development cycle (requirements, analysis, design, evolution, and delivery) is now mapped to this sprint(s). The traditional development stages are retained for convenience, primarily for tracking milestones. The keys to Scrum are deciding the completion date for production or release, prioritizing functionality, identifying available resources, and making major decisions about architecture. Compared to more traditional methodologies, the planning phase is kept short because we know that events require changes to initial plans and methods. Scrum uses an empirical approach to development where interaction with the environment is not only allowed but also encouraged, thereby changing the scope.

- Crystal methodology: Methodology elements can be reduced to the extent that running software is delivered more frequently and interpersonal communication channels are richer. The human-centric approach really focuses on enhancing the work of the people involved on the project. Each member of the Crystal family or methodology addresses different project needs. The focuses of Crystal methodology are to (1) capture those components that make projects successful and (2) provide the project team with sufficient leverage and freedom to perform its work in a fun and creative manner. Additionally, smaller project teams develop better results because the communication is improved largely through close personal interaction and feedback between users and the team is encouraged.

- Dynamic Systems Development Methodology (DSDM): The DSDM, developed in the United Kingdom, is based on Rapid Application Development (RAD) that uses prototyping reiteration to deliver projects. This model has several aspects that differ from most common models. The difference is that time and resources are fixed and functionality of the deliverable is variable. In other models, the functionality (or product) is fixed, and resources and time are, to a certain extent, flexible.

- Rapid Application Development (RAD): RAD uses shorter project phases, which means that benefits are realized much more quickly. With RAD, each iterative development cycle delivers a functional version of the proposed solution. The approach is almost cyclic in nature. However, many organizations don't have the time to spend lengthy periods on development; they want to see immediate results. By following a RAD methodology, clients are able to use a "building block approach" to see the results. Using RAD, results are almost immediate and the product starts becoming tangible.

Agile methodologies better suit small projects where smaller project teams are involved. With larger team size and the complexity and duration of the project, the choice of a heavyweight methodology is purely from a command and control perspective. Many smaller companies do not use heavyweight methodologies and prefer the more agile approach to building solutions. [5]

C. *Rational Unified Process (RUP) Project Framework*

The Rational Unified Process, or more affectionately referred to as RUP, is a customizable project methodology framework aimed primarily at software development. It is a complete software development process framework that comes with several out-of-the-box examples. This methodology enhances team productivity and delivers software best practices to the project team through a set of components, which in turn consist of guidelines, templates, and best practices from thousands of development projects. From large-scale enterprise to agile projects, RUP allows organizations to develop projects more rapidly and deliver quality even when using this process. RUP is not merely a process. It is valuable because it embodies many of the best project management practices available today, thereby making it a flexible framework to which project managers can apply their solutions.

Companies such as Wells Fargo and Merrill Lynch and numerous others have used RUP successfully. (Figure 2)
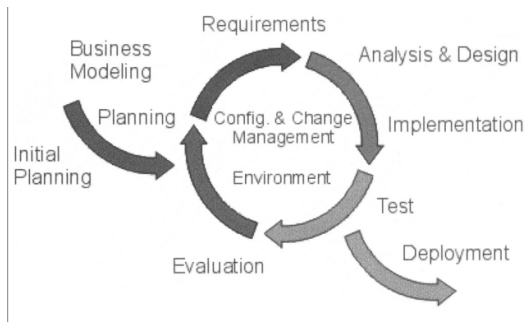

Figure 2: RUP cycle. (Source: Life Cycles of the Rational Unified Process. Reprinted with permission.)

D. Six Sigma methodology

Many organizations are realizing projects according to this methodology. The research results of many experts from different areas contributed to the development of nowadays Six Sigma principles. Two main methodologies that use Six Sigma projects are: DMIAC (Define, Measure, Analyze, Improve and Control) – that serves for development of existing business processes; and DMADV (Define, Measure, Analyze, Design and Verify) – that is used for the new product creation or process design in order to get predictable and zero defect features.

Many organizations apply standard or methodology in order to satisfy their needs. For example, if an organization uses PMBOK as the main project management methodology it still needs a lot of experience to adopt this methodology completely.

IV. RESEARCH RESULTS

Picking a methodology is like deciding which recipe to follow when baking chocolate chip cookies. One recipe might use room-temperature butter while another recommends melted margarine, or call for dark chocolate instead of semi-sweet chips. Each recipe gives delicious cookies, but the steps, ingredients and techniques are all a little different to suit different taste buds. Picking methodology which is based on available ingredients such as: project constraints, timeline, tools, and people, is always the best way to be successful in delivering different projects. [9]

By using the new IT project management software, as well as applying different methodologies in project realization, many projects are realized nowadays in companies. Successful methodology application may be seen in the real world examples in companies that use specific methodologies in their business processes.

A. How Sony Ericsson solved problem with PRINCE2 methodology

Management team at Ericsson faced all of the problems unique to such an enormous company; it had many different projects to manage, many diverse teams of project managers, and faced linguistic, cultural and geographical challenges innate in its global nature.

PRINCE2, however, was equal to the challenge, and was seamlessly integrated alongside the working project management methodologies which existed within the Ericsson network. These were suitable for large projects which made changes to complex telecommunications infrastructure, whereas consumer-based and operational changes demanded the more clearly-delineated project management system embodied in PRINCE2.

The set milestones and fundamentally inflexible nature of Ericsson's existing project management procedures tended to alienate collaborating with outsiders and was unsuitable for the iterative software creation projects being spearheaded by the Customer Management Solutions Business Unit at the company. PRINCE2, then, lived up to the challenges posed by Ericsson, constituting a methodology which was flexible and agile enough to suit all sorts of business software projects while still remaining structured enough to provide support, transparency and accountability.

In the case study, which appears on industry websites and on Ericsson Services Ireland's website, the business case for choosing PRINCE2 was based on the following:

- The old methodologies were too inflexible for the projects within the group.

- The old methodologies did not cater for dealing with sub-contractor management.

- The rigid milestones and rules did not deal with iterative and overlapping phases of a project.

- Projects were being delayed by the rules imposed by the old methodology.

- Improving old methods was taking too much time away from core business activities.

- Business decisions were being taken at inappropriate milestones. [7]

B. Use of SCRUM in Telenor Serbia

The objective was to launch the new portal in beta version as soon as possible, to realize only the

set of features necessary for launching, and the rest of features as well as the future requests should be realized on the fly. Two weeks after the initial idea it was time for the first sprint. In order to arrange sprint planning together with the business stakeholders Product Owner prepared Product backlog (the list of required features). ScrumMaster is not obligatory participant in Product backlog creation, but he/she may assist and be consulted if it is needed. Workshop for Product backlog update usually lasts one working day and then every business stakeholder adds his/her requirements to the list. Taking into account importance and order of realization they set priority for every requirement. Based on the completed Product backlog the entire Scrum team, i.e. Product Owner with his/her team, ScrumMaster and development team perform grooming of the Product backlog. In the start they eliminate requirements whose realization is not possible, or the ones not enough well defined, in order to avoid losing time on its reconsideration during the sprint planning. Grooming lasts for a few hours, or one working day at most. The next step is the one-day workshop for sprint planning that includes the entire Scrum team, as well as the business stakeholders, owners of the features from the Product backlog. The sprint duration is previously defined and usually lasts up to two or three working weeks. It starts with requirements analysis from the beginning according to the list with requirements sorted by priority, starting with the ones with the highest priority. At the same time user story represents success criteria that is used, after the sprint execution, as success verification of requirement realization. During two weeks only, E-business team succeeded that from bringing idea to making decision, gain enough basic knowledge, necessary approvals from the top management and to start with agile approach application. The first sprint started at the beginning of the second quarter in 2014, and its goal was to launch the new selfcare portal as soon as possible. Beta version of the portal was launched for less than two months, after three successful sprints. Without agile methodology application and Scrum approach the most of these features would never be realized. [8]

V. Further Work

In order to become more successful in IT project realization recommendation of the new methodologies is given as follows.

A. Kanban methodology

If a continuous workflow and outputting a slow and steady stream of deliverables are your main priorities, Kanban is a good fit. Managers create visual representations of the team's workflow (often using a whiteboard or sticky notes) to uncover process problems and prevent tasks from stalling as unending "works in progress." The sticky notes move across the board to tangibly represent project progress.

Advantages: Kanban helps teams understand where their time is really being spent so you can improve efficiency.

Disadvantages: Variations in customer demand — like the start of the holiday season, or a drop-off due to a product recall — can make Kanban inefficient, since it's designed to produce a small but steady output.[9]

B. Lean methodology

Lean is all about finding the path of least resistance to get the results you want. Start by creating a full work-process breakdown to find and eliminate bottlenecks, delays, or other waste (called mura). Teams focus on the project's true customer value, and on continuous process improvement. The goal is to do more with less: deliver high-value, high-quality work with less manpower, less money, and less time.

Advantages: This approach is especially helpful if you need to cut your budget, meet quick deadlines, or get big results with a small team.

Disadvantages: Since the ultimate goal is to get things done faster and cheaper, stakeholders need to make prompt decisions and be prepared to stick to those decisions — weighing options for weeks interrupts the Lean process.[9]

C. Lean Six Sigma methodology

It combines Lean's efficiency with Six Sigma's statistics-based process improvement. It corrects workflow problems and eliminates waste by helping you understand how work gets done and identify which aspects of your project are most valuable to the client or customer.

Advantages: In addition to making your projects more efficient and cost effective, Lean Six Sigma keeps employees actively engaged in process improvement, leading to a sense of ownership and accountability.

Disadvantages: Lean Six Sigma usually involves major change to the way work gets done, so make sure you — and company execs, stakeholders, and other managers — are prepared for the amount of time, effort, and resources needed to be successful with this method.[9]

D. The Waterfall Methodology

The methodology, currently one of the most widely used, gets its name from the analogy of water falling downward. The waterfall model is a

diagrammatical representation depicting the main phases of software development. There are three main types of waterfall methodologies to consider when assigned a project. These three waterfall approaches depend entirely on a project's target date. These categories are:

1. No overlap,

2. One phase overlap,

3. Overlapping phases.

The disadvantage of the waterfall methodology in general is that it can be largely documentation-driven, which consumes time. The waterfall methodology makes it easier on the project manager and difficult on the client. [5]

VI. CONCLUSION

Project management proved to be the reason of project success and it really makes the difference.

Beside general project management many specific methodologies were developed during time, depending on project type.

They are recognized as very important factors of project success and now they are subjects of study programs at technical faculties.

In this paper several project management methodologies was described, with special preview of concrete application of different methodologies in companies.

The Recommendation of the new methodologies is suggested as well, in order to improve project realization and accomplish its success.

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CONTEMPORARY USE OF INFORMATION TECHNOLOGY

Healthcare Education at Internet

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Abstract - Internet become source of information for many categories of people, such as professionals, adults, children and others. Information regarding certain aspects of healthcare is available from diversity of web sites. This paper presents analysis of related work on using diversity of Internet services in health-related education for patients i.e. "health consumers", as well as medical professionals.

I. INTRODUCTION

Internet became one of the fastest sources of information, adaptable for using from both computers and mobile devices. Growing population of internet users ("As of August 2012, 85% of adult U.S. population used the Internet"[1][2]) lead to increasing number of available internet services ("the plethora of communication channels in the Internet, such as the world wide web, e-mail, newsgroups, online forums, chat rooms, instant messaging, online social media etc." [2]), while directing developers to constant improvement of quality of these services.

Significant number of internet web sites, as well as appropriate mobile phones (i.e. smartphones) applications [3] that use internet information are dedicated to provide healthcare information or to enable healthcare-related information services. It is of a great importance to investigate and raise awareness of [4]:

- Possibilities of using this technology to increase healthcare effects,

- Potential threats to health due to inappropriate use of this technology.

This paper presents analysis of published papers, that are related to the problem of healthcare information at internet. Particular concerns are given to analysis of healthcare education at internet.

II. INTERNET IN HEALTHCARE

In research [4] it has been shown that internet is used as:
- A resource for health information, with potentials to educate health consumer.

- A medium for interaction – using e-mail for communication between doctors and patients, including patients in virtual communities with anonymity that could enhance including patients with embarrassing health conditions or rare diseases. Possible problems o come very often from lack of professional moderation of these virtual communities, which could lead to inappropriate use and dissemination of inaccurate messages. Another problem is that virtual communities' communications could become addictive to some users.

- A tool for the delivery of healthcare – online health record enables telemedicine remote diagnosis and "virtual outreach" consultations in areas with poor access to conventional services, psychological consultations, including patients to interact and share decision-making, healthcare monitoring [3], online interaction with health professionals [15] etc.

- A medium for health research – using online interviews, quantitative survey methods…

III. INTERNET IN HEALTHCARE EDUCATION

Internet is used in healthcare education with two groups – medical professionals and patients/health consumers.

A. Medical Professionals

Research [5] was conducted as a survey on Internet medical information seeking by 2200 physicians (32% primary care, 68% specialties). Table 1 shows results on the survey related to using Internet.

Table 1   Physician Experience
in Internet Use (%)

Electronic mail	90
Personal use	86
Literature searching	65
Searching for medical information	53
Professional association updates	33
Accessing on-line journals	45
Continuing medical education	31
Searching for specific patient information	29
Consultation with colleagues	17
Filing insurance claims	13
Participating in clinical trials	7
Writing prescriptions/patient orders	2

In [5] has been shown that medical professionals use internet for continual education, research and cooperation with other colleagues, as well as searching for particular patient specific problem information. Most important requirements for quality of information and information services at internet were pointed as: credibility of the resource, quick and 24-hour access, as well as ease of precise searching for particular data.

B.   Patients and "Health Consumers"

Research [6] results showed that "two/thirds of those using the internet to find health information claim that it has some impact on their healthcare decisions" [4]. The potential threats to health of internet consumers is using internet information as basis for their health decisions, since internet information is sometimes incomplete, ambiguous, inaccurate and credibility of internet sites should be carefully examined.

Particular concern must be taken with young internet users, especially in developing countries. In [7], research results on using internet for health information among undergraduate students at Nigerian University show that:

- Young people access internet via cybercafes (40%), personal computer system (37%), mobile phones (17%) and school laboratory (7%)

- Constraints to internet access include slow connection, cost of access, power supply…

- Trustworthiness of online health information is estimated as unreliable – 4%, fairly realiable 23%, very reliable 39%, accurate 34%.

- Decision making after having health-related information accessed from Internet – Visited orthodox physician (51%), Visited traditional healer (14%), self-medication with patent medicine vendor (10%), confined a friend for

suggestions (22%), did not take any step (15%).

Particular benefit of internet in health education is shown in rural areas. In research [8], creating web portal for health education ("My Health Education and Resources Online") has shown benefit from using particularly in rural areas of US. Empirical research has shown positive, but limited results, with diabetes disease patients who used education materials, quality of life measures and self-management instructions from the developed internet portal.

Internet includes many services, such as web sites, but also e-mail service could be used for the benefit of healthcare information and education, which lead to lower healthcare costs and raise of healthcare quality of service. In research [9] the use of e-mail discussion group for back-pain problems improved health status and lower health care utilization with patients included in this research.

Using social networks, such as Facebook, show good potentials for spreading health-related information. Study [10] shows significant success in dissemination of health information with example of breast cancer prevention. Success is limited generally, since social networks are used more by young people, even number of middle-aged people using computers, internet and social networks is rising.

Certain well-recognized institution with high professional and scientific credibility establish their educational and research centers, such as Stanford Patient Education Research Center [11]. They organize internet-based workshops with primarily aim to establish self-managed personal health-care. Particular focus is on people with chronical diseases. Workshops are facilitated by leaders with their own health problems to facilitate highly interactive workshops to build self-management skills, raise motivation, share experience and support. These workshops are based on previously tested research results with smaller test groups.

Figure 1.   Stanford Patient Education Research Center website [11]

Due to large quantity of information at internet, often available unchecked, disorganized and with problematic credibility of source, it is of a great importance to educate patients as well as medical professionals to teach patients to utilize the Internet effectively to better supplement their care. Paper [12] presents efforts in workshop-based training of medical students to empower them to educate patients related to the appropriate use of Internet for health-related topics search and evaluation.

Importance of searching and getting precise health-related information to patients is emphasized in research [13]. This research is conducted in aim to determine association between health condition of people that search internet for health-related information and the type of information they are searching for. Research is conducted with survey where European Union citizens were asked about their own health condition and utilization of internet for health information. It has been shown that "those searching for general information were less likely to report bad health whilst those searching for disease-specific information were more likely. Searching for general health information may be more conducive to better health, as it is easier to understand, and those accessing it may already be or looking to lead healthier lives. Disease-specific information may be harder to understand and assimilate into appropriate care worsening self-rated health. It may also be accessed if health services fail to meet individuals' needs, and health status is currently poor. Ensuring individuals' access to quality health services and health information will be key to addressing inequalities in health." [13]

In aim to empower patients with health-related knowledge, there are some limitations of regular use of internet websites. Some of these limitations are [14]: a) the information available does not specifically focus on individual's current health

problems, b) large volume of information, c) relevance of information, d) requires individual effort to collect data. One possible solution is in automation of previously mentioned activities in collecting, evaluation and "pushing" personalized health-related educational content to users. In [12] was presented a system named PHI (Personalized Health Information) with both "push" ("system motivated" – sending personalized e-mail to users) and "pull" ("client motivated" – starting system and getting personalized content within web browser) approach support developed.

IV.   BENEFITS AND ISSUES WITH INTERNET-BASED HEALTHCARE EDUCATION

Potential benefits for "health consumer" in online health-information seeking could be summarized as [15]:

- Widespread access to health information

- Interactivity

- Tailoring of information, support to personalization

- Potential to facilitate interpersonal interaction and social support

- Potential for anonymity

There are several causes that could lead to issues in using internet for healthcare information and education:

- Demographic – "individuals who are less educated, economically disadvantaged, older and socially marginalized remain least likely to access health information on the Internet and thus were isolated from the 'digital culture'. Those who have the greatest need in health information may not be able to benefit from the emerging technology".[2] Rural, isolated, low socioeconomic status, elderly – those in greatest need are least likely to have internet access [15].

- Low accuracy and non evidence-based information at Internet, anonymous nature of the Internet could lead to vulnerability of misinformation from the Internet [2].

- Barriers to online health information include cost, geographic location, literacy, computer skills and institutional policies, English language and health literacy[15].

- Design features of information at internet could lead internet users may find health information functionally inaccessible [15]: Information overload, disorganization, searching difficulties, presentation of content in highly technical language, lack of user

friendliness of user interface, lack of permanence (inconsistent updating – information may be out of date, web sites disappear, change and move without warning).

- Information related issues [15] – lack of peer review of information or regulation, there is no quality filter at Internet (everyone can develop an internet site), inaccurate, misleading and dangerous information, consumers' evaluation skills, risk-promoting messages abound, potential for online pathologies and maladaptive behaviors, etc.

V. CONCLUSION

As Internet became one of sources that offers fast and easy access to information, it influenced part of Internet using population to be directed toward Internet in the health-related information seeking.

There are many different Internet services that enable information access and interaction with other people. When health-related information is concerned, most frequently used are e-mail, web in presentation of information, social media support, chat and forum forms of interaction. Particular features of Internet that bring large popularity are: wide accessibility (from different locations and devices), anonymous interaction and diversity of information sources.

Issues that bring limitations to use of Internet generally are related to demographic characteristics of people, but also characteristics of internet itself, design and information sources and accuracy characteristics.

The need for fast, accurate and precise information related to healthcare conditions of "health consumers" is defined as the mayor targeting quality that should be available with internet solutions. More proactive approaches bring automated "push" approach (example of PHI system) that sends by e-mail educational content to health consumers precisely according to their personalized needs (i.e. healthcare conditions) defined within the system.

Future activities in this field could lead towards establishing internationally accepted legislation that would legally regulate quality of information, i.e. credibility of web sites related to healthcare information. Another direction could be towards automated tools for improving health-related search, as well as integration of devices for health-state monitoring with remote healthcare institutions that could monitor health conditions of patients in rural areas or of elderly patients. This way, full potentials of Internet could be used for the benefit of healthcare of individuals with healthcare needs.

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Design of Information Systems Monitoring, Record and Control

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Abstract - Logistics management information system is essential to provide management with the knowledge to exploit new markets, make changes in the design of packaging, make a right choice in store to raise or reduce inventory, to determine the profitability of customers and establish profitable level of customer service, choose transporter and determine which system of processing orders will be automated.

To bring these strategic decisions management must know how you are changing costs and revenues dependent on appropriate alternatives would be selected. An advanced system for order processing is able to provide much information to different departments in the organization. Terminals for access to data can be made available to logistics management, production and marketing department. The system can provide a variety of regular reports and reports on the current situation upon request.

The design of logistics information systems begins by examining consumer needs and determination of standards features to meet those needs. Next you need to make is the need for consumers to compare with the current capabilities of the company, and to explore current operations in order to identify areas that require monitoring.

It is important at this level to interview different levels of management. In this way the company can determine what strategic and operational decisions are made and what information and in what form is needed for decision making. The next step is an examination of current possibilities for data processing companies in order to determine what changes are needed.

Finally, the database could be created and the reports should be designed taking into account management costs and Uses of each report. Good system design must be of benefit to management and to provide movement of information from where they are collected to the appropriate level of management. Phones and tele printer connections between computers are just a few of the materials which can transfer information. For additional information processing computerized information system must possess capabilities to store data.

Data of logistics information systems may come from multiple sources from which the most important are the following: System processing orders; Statements of the company; Data from the farm; Data from management.

I. INTRODUCTION

A. Software system for monitoring, recording, analysis and statistics in "Filed Ops" subsector in the company for telecommunications services

Field Ops (Field Operations) in a company for telecommunications services represents a service for carrying out field operations in terms of construction and maintenance, i.e. maintenance of the telecommunications network (cable, wireless, optical coaxial et seq.) And assignments on the field with users: physical connection of users to the network, turning off users from the network, resolves defects network and beneficiaries.

Numerous everyday Field Ops tasks impose the need for an organized system of monitoring the network, receiving treatment and management of client requests and coordination, or dispatch tasks and running the specialist teams in the field.

These complex daily field operations more efficiently and effectively managed through an electronic system for monitoring, recording and dispatching. The principle of this logistics system is as follows: 1. all information (requests for connection charges or defect) of customers is entered into the electronic system software by employees in the call center. It contains data on the client, while the hour and minute of the receipt of information, address, type of request (and you plug defect), data on who has entered the information into the system and etc. 2. An automated system for monitoring network status and the level of critical

signals in the correct network in the form of measurement values are also available in the electronic system. 3. Dispatchers from the central dispatch center monitor this information to select and create problems in the form of electronic work orders to the teams on the ground in the cities chosen taking into account the optimal use of all resources available now. 4. Specialist teams on the ground in each city, at the same time receive electronic work orders selected for each team separately. Electronic jobs contain data on the name of the specialists in the team, the car, time and place of the scheduled task, job description with possible objection is taken by then, and so on. 5. Specialist teams in the field are in constant communication with the dispatch center and voice and electronic, in order to solve the tasks of the fastest, most economical way and most efficient. 6. After completing the task, it is "close" to the appropriate note and thus recorded operating supplies and other resources that were used. 7. Electronic System for dispatching the "Field Ops" allows for analysis and statistics for all completed tasks and tasks waiting to be completed. Information can be requested for any period that is the subject of interest.

Figure 1. Introduction and monitoring of all faults

Figure 2. Create work orders for each specialist team on the field

Figure 3. Statistical data on the performance of each manager

Figure 4 Data on the current activity of the specialist teams in the field

II.   CONCLUSION

The development of information technology divide to a number of changes in the operation of modern companies Worldwide. In a world still in the seventies of the last century McLuhan described as a "global village", the adaptation of companies to the world's trends, especially in the application of information technology to monitor and record the logistics processes of a company, not a matter of choice business strategy, but it necessity as a precondition for the survival of uncompromising competitive global market. With the integration of logistics processes, reduces the need for repetition and entering the same information in each of the software systems. Their integration into a single logistic chain, unless significant savings creates benefits for all users. Relevant and timely information derived from the monitoring and

recording of logistics systems and processes within a company is an important and necessary tool in making appropriate strategic and operational decisions in the company.

Investing in modern IT logistics systems for monitoring and recording companies in multiple paid for a very short period of time.

Despite all these positive aspects of the implementation of modern technology for monitoring, recording, analysis and statistics in the

Companies, it seems that is not yet sufficiently represented in all structures of economic entities. That process is expected to intensify in the near future creating conditions for faster overall economic development in general.

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First Errors and Corrections while Teaching Evolution of Software Systems

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Abstract - As reaction on industrial needs, our department realized significant changes in the curricula. One of these changes was that more emphasis was made on phases of software life cycle, which are after system delivery - evolution, servicing and phase-out. Also legacy systems became emphasized to point out the importance of program comprehension and quality measurements. We dedicate this paper to the evaluation of the first year of the implementation of the Evolution of Software Systems subject. We present errors we identified along with the solutions we implemented. As conclusion, we present the improvements we suggest based on our experiences.

I. INTRODUCTION

As we already presented in our previous papers [1] and [2], there were huge modifications introduced into our Informatics curricula on both Bachelor and Master level. First kinds of these changes were renewed subjects, other completely new ones. The subject entitled Evolution of Software Systems is one of these new subjects, which aim to fill the gap that was identified as uncovered software engineering activity during the analysis of the previously accredited Informatics study programme.

The missing software engineering discipline was software evaluation (and testing) and the consecutive correction of the found faults, failures or errors and inclusion of new functionalities based on new requirements raised during software system operation. We consider all changes in the software made after its first delivery as software evolution [3]; evaluation and testing [4] of the software system is therefore considered as the starter act of any kind of evolution [5].

The phases of the software life cycle we considered to be worth to include into the list of topics of the curricula consist of evolution, servicing and phase-out [6]. We also emphasize the last mentioned phase while dealing with legacy software systems [7], [8].

The first year of the subject implementation differs to the upcoming ones in a very important property, namely in the number of the attending students. The curriculum contains the Evolution of Software Systems subject for both first and second year of the Master level of the Informatics study programme. That means that the attending students are of different level of knowledge when entering the subject; and the teachers' goal is to take them to the same nontrivial level when passing it. The room to apply principles to ensure equity in this situation is significant, as the students require the application of this principle over the principle of equality.

Another issue was the trend of sharing tasks between subjects. We will discuss this issue as well later.

To conclude the presented introduction, this paper states the goal to present the evolution of a subject related to software evolution in a heterogeneous environment in both knowledge level of attending students and sharing particular tasks with other subjects. After presenting the subject organization, we stop by the identified faults and errors and present our reactions on them. Last, we discuss possible improvements and restrictions that aim to improve the subject image for the next several years.

II. STRUCTURE OF THE SUBJECT

A. System of the subject

The implementation of the subject was based on a Moodle LMS course (in the next section we present the details). The system of the realization was intentionally kept as simple as possible that the students do not get confused of the organization.

The students worked in four-member teams, in some cases this number was allowed to be 3 or 5. Each team member could receive a different score for each of the semestrial tasks as well as at the exam.

Evaluation of the semester was divided into five sections, in which sections the possibility to gain 40 points was distributed:

1. Project measurement, where the main task was to bring own projects and measure their complexity in relation to a possible maintenance or evolution of the resulting software system.

2. White box and black box testing of selected own projects, including presentation of testware used and results achieved, e.g. tools and error reports.

3. Measuring user experience (UX) from own software solutions by analyzing colleagues' feedback.

4. Evolution of own software based on results from the testing phases.

5. Retrospective of implemented tasks and their relations, creation of release plans.

The exam structure was as follows:

1. Moodle LMS test consisting of 15 questions (theoretical and practical). Each right answer has a value of 2 points; 30 points in total.

2. Verbal exam with three questions – 10 points each.

A complication into the clean system and structure of the subject was injected by sharing tasks with another subject. This subject was defined by our Department, but the realization was made in the industry. The complications became visible when the realization could not be synchronized with the Evolution of Software Systems subject.

B. Moodle LMS implementation

The course was defined in a rather standard way in the Moodle LMS environment [9].

We used a 26-line text for course description, in fact, no students asked on the conditions during the semester. It seems that this section is really important to fill at the beginning and should be never a subject of change during the semester – at least we kept it unchanged and this helped us also to formulate this paper.

Application of the Moodle feature regarding student groups was also emphasized. We created groups based on the schedule as well as by the team tasks. The internal list of team members created this way was then published within an internal web page to help the organization, orientation and teamwork.

The weakly structure of the course was enriched by lectures, supporting material, and everything besides activities such homework essays or online questionnaires. The list of topics and tasks is presented in Tab.I.

TABLE I.　　TASK TYPE DISTRIBUTION FOR THE EVOLUTION OF SOFTWARE SYSTEMS SUBJECT

Week	Task		
	Regular	*Homework*	*Lecture*
1	Introduction, questionnaire	bring own projects	1.pdf
2	measurement	fill report	2.pdf
3	white box testing	-	3.pdf
4	white box testing	upload reports	4.pdf
5	black box testing	-	5.pdf
6	black box testing	upload reports	6.pdf
7	evolution	-	7.pdf
8	evolution	upload reports	8.pdf
9	UX measurement	-	9.pdf
10	UX measurement	upload reports	10.pdf
11	retrospective	-	11.pdf
12	retrospective	upload final versions	exam schedule
13	credits, exams	-	1st exam

III.　ERRORS

A. Project complexity measurement

The task of project complexity measurement invented two types of errors. First, several students had a problem with the homework to bring one of their own projects. Second, the majority of those who brought a project also used development tool built-in complexity counters to evaluate these projects. It led to the problem that a significant number of students did not really try any complexity calculation formula. The aim of the task got broken this way. The solution for the missing projects could be solved just in time, but the solution of the partial cheating needs a change in the structure. Any just in time solution would violate the protection of the rules stated in the first week of the semester.

B. Testing

As students had different entrance level of knowledge, some of them even had a problem during testing. Concretely, a group of about 40 students had projects in MATLAB, but they never got explained MATLAB code testing. The occurrence of such problem proves the need for the subject, but there

was no prepared solution for this specific case. This error could be solved just in time.

C. Task sharing

As it was already mentioned, within the subject we allowed task sharing with an industry-inspired subject. The proposition was that there would be a need of evaluation (testing and measurement). The problem in the case of the majority of the student projects was that these projects were very far behind the expected stage to be able to get tested or measured. Just in time solution was carried out, but the effects point rather to a more radical solution.

D. Position of "evolution" in the schedule

Somehow, the "evolution" task landed before the user experience measurement, which turned into a problem that user experience reports are not used in evolution. There was no applicable just in time solution because of the declared change immunity of the schedule presented in the first week.

E. Bonus points and student motivation

We defined various levels of bonus points, which led to a situation that the amount of bonus points had to be limited. Another option was the possibility of taking the bonus points to the exam under specific circumstances. The result was de-motivating. Students used the first weeks to gain as much as possible bonus points, and at the end of the semester they used these points to replace regular activities. E.g. they did not mind for a zero-score of a later activity because they already had the bonuses. The same applied for the exams.

Our aim to motivate the students through the whole semester received a bad ending by decreasing their activity in the second half of the semester.
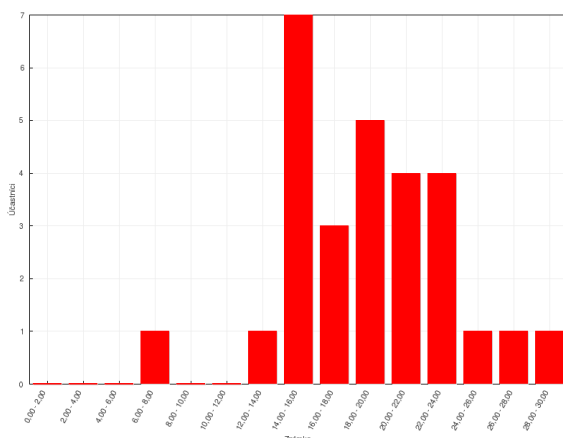
F. Sharing exam questions

Students at the first exams performed as expected, but later the problem arise that everyone seemed to know the questions in advance. As illustration, we present two result sets from the tests in Figures 1 and 2.

Just in time corrections in the system could be applied, these also indicate a possible long-time solution.

Regarding the verbal part of the exam, students had no option to skip it in the case of high test results or bonuses, therefore the final grades were less effected by the tests. Still an improvement can be made to eliminate the too high impact of the bonuses. Verbal exams eliminate the discrimination introduced by simple testing of students, where students with worse access to materials are discriminated against students with very good access to these materials (bordering with cheating).

IV. CORRECTIONS

A. Project complexity measurement

The task of project complexity measurement invented two types of errors. First, several students had a problem with the homework to bring one of their own projects. To solve this problem, we provided a just in time solution by sharing student projects from previous years from different subjects to them.

Second, the majority of those who brought a project also used development tool built-in complexity counters to evaluate these projects. In the future years, besides the results, we will also require the whole calculations to be submitted. This will not limit those who want to use a tool, but might make them think about the correctness of the implemented formulas against the theory.
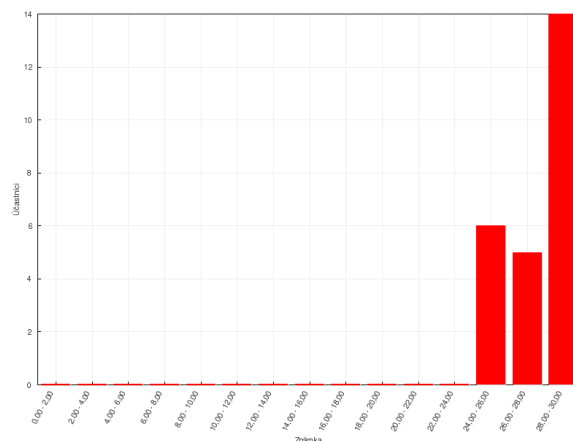

Figure 1. First exam result distribution chart

Figure 2. Second exam result distribution chart

B. Testing

As students had different entrance level of knowledge, some of them even had a problem during testing. Concretely, a group of about 40 students had projects in MATLAB, but they never got explained MATLAB code testing.

Our just in time solution was adding a reference to [10], where the required terminology is illustrated. In the future years, we see a possibility to extend the course material in the same way – adding new supporting material on demand.

C. Task sharing

As it was already mentioned, within the subject we implemented task sharing between subjects. The long-term solution (by now) indicates the elimination of this feature.

D. Position of "evolution" in the schedule

Somehow, the "evolution" task landed before the user experience measurement, which turned into a problem that user experience reports are not used in evolution. The obvious solution is to switch the evolution phase with the UX phase, but there is a possibility to shorten the UX phase and introduce a second evolution rather.

E. Bonus points and student motivation

We defined various levels of bonus points, which led to a situation that the amount of bonus points had to be limited.

The correction to be implemented is that the amount of bonus points will be limited from 5 to 2 for each activity. Another limitation will be that a student has to use his bonus points at semester level, and only those can use a limited number of 5 bonus points at the exam, which did pass the semester with full points score without a need of using any bonus

point.

F. Sharing exam questions

We implemented a just in time solution by adding new questions to the test base every week.

The results presented in Fig. 3 prove our concept so far. The future solution will not add new questions all the time (as every domain is limited), but we will propose different versions of the question database to be used with different exam dates.

V. DISCUSSION

We introduced a new subject, which uses the equity principle over the equality principle in the field of software engineering education.

The resulting subject named Evolution of Software Systems went under the first testing semester – attending over 200 students from two years of the Master level of Informatics study programme.

The first year of implementation started with a couple of compromises and brought several critical errors, which require a change in the next year. Other smaller errors could be solved as they appeared.

Considering equity over equality, this aim is very hard to achieve because of the sharing option – this is the first point of improvement that has to be carried out.

Another discovered and hard to deal with problem was the difference in the programming skills of the students. Ones preferred MATLAB, others did not even want to hear about it. Equality would mean everyone has the same task; full equity would be about the possibility of existence of individual tasks. By the present amount of the students, teamwork has to be kept for the future, which requires a certain level of agility in task definition and evaluation, which is unpredictable when applying together with the equity principle.

Bonus points over-motivate students in the first weeks of the semester, but later they are more de-motivated by the amount of them. The amount of bonus points should be decreased. On the other hand side, the way these bonuses can be achieved has to become harder. Still keeping an eye on the equity, but with an aim to define a good selection of the students. This selection might also help to select the best students to the most important diploma thesis implementations. However, students have to keep the right of choice of their thesis topic!

Figure 3. Later exam result distribution chart

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3 Dimensional Modeling and its Integration in Technology Education

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Abstract - In the last few years changes have taken place in the public life which mark on the education. The new requirements of the modern world placed before the teacher a huge challenge: "to offer the younger generation new education which are passed according to modern requirements and standards of Europe, taking into social and cultural features of the country"[[5]]. Along with the theoretical knowledge the learners should learn a number of practical skills, related to their technological culture. Three-dimensional computer modeling with Google SketchUp and its application in technological education show a new "virtual" world, filled with creativity and professionalism. The modeling should find a permanent place in learning programs of students in order to facilitate their future realization.

I. INTRODUCTION

The authors of the modern didactical literature agree on the need to use teaching aids in the learning process. Those aids are one of the most important to realize the didactical principles for visibility and activity.

To form the student as a person, his preparation as a competent and competitive citizen, raise the need of discovering new areas of individual expression, of his potential to strengthen his self-confidence. Moving the center of the educational activity to the learner raises new challenges, requires the search of new ideas and solutions; knows the individual needs, interests, possibilities and realize the interests and the capabilities, present the creative beginning of the individual.

The development of the computer graphics makes easier to interact and better to understand and interpret various data types The development of the computer graphics influences different types of media and makes a revolution in animation, movies and video games. Today computers and computer generated images are related to various aspects of the daily life. Computer images are found on TV, in newspapers, in all medical and chirurgical procedures. One well-made graphic can present complicated statistical data in an easy understandable form.

Many powerful tools are developed for data visualization. Computer generated images can be categorized in several different types: 2D, 3D, 5D and animated graphics.

II. THREE DIMENSIONAL MODELING

During the lessons of cultural-educational area "Engineering" the students get to know the methodology of making experiments in order to gain knowledge about the work organization, the consistency in performing experiments and their safety. The main purpose is to make the learners to understand their knowledge in certain practical situations.

The integration of the three dimensional modeling in education implements a better opportunity to develop a technical thinking with its important characteristics, operate with spatial ideas and support of visual materials. It develops better spatial imagination by emphasis the process of schema understanding and by connecting the terminology with the concrete practical assignment. Today the traditional didactical aids are replaced with the digital multimedia and electronic communication.

Practical activities in 3D modeling develop the human observation, make student focused on detecting causal connections between phenomena, form conclusions. Students receive sensory perceptions needed to detect the nature of the studied objects through:

- **modeling** /the objects are considered as models /.

The model unnaturally reduces different parts of the objects and phenomena: simplification, approach and mapping the reality. "Modeling immensely helps the student in cognitive activity in the level of the abstract thinking because it highlights the important properties of the modeled objects". [[1]]

- **real objects in real conditions and actions.**

Much of the information that we receive is transmitted through images. The creation of "augmented reality" through three dimensional realistic objects placed a new beginning in the use of technologies. They are widely used everywhere around us and for that they must find their place in the learning process.

The main ways for the three dimensional modeling for transforming objects, motion, visualization depend on the used software. For that purpose, there have been created newer and even bigger software for three dimensional graphics and animation - Maya, Google ShetchUp, etc. That augments the area of three dimensional computer modeling because of the different unlimited objects transformation.

In technological education for realization of three dimensional modeling the most used software is Google ShetchUp. With its use students can show their skills in understanding of graphic exercises, making technical and elementary drawing; moving elementary drawing from one material to another and etc. They can gain skills in comparison of an object and its model, which does not contain all graphic details. They can compare real detail and its drawing, partially or completely understanding the drawing (determine the form, size, material, type of relations between the details, etc.)

In Google ShetchUp this is accomplished by using a set of tools and commands with multiple possibilities of modification, transformation, parameterizing of the light, textures, materials, ready geometrical objects and forms (shapes). [[2]] Computer modeling gives the opportunity to create three dimensional models for different industrial products – plastic and color solutions of interior design, visual effects in cinema, in multimedia, advertisements. It is applicable in technological education by integration of computer graphics, computer modeling, modeling of industrial shapes, etc.

The work with professional three dimensional software requires creative imaginations as well as analytical thinking [[3]]. The use of software for three dimensional graphics first of all means the creation of three dimensional models. The important for improvement of the realism of the created models is the tools for setting the lighting ad shadows. Google ShetchUp gives the opportunity to change the parameters of the objects surfaces (roughness, material) and the background. The process itself must figure it out from the beginning why there is so much possibilities to create one model and the best option must be selected. Series of actions that are easy and accessible for some

teachers and students can be not preferred from others. In computer modeling in technical education libraries with personal effects, textures, materials can be multiply used and that way the development process of other projects can be facilitate.

III. POLYGON DESIGNING WITH GOOGLE SKETCHUP

The main thing in the use and the creation of three dimensional models is the quality of polygons – important for the work system indicator. The more they are, the model would be with better quality, but it would be more difficult for the computer and vice versa. Google SketchUp offers tools for import and export from and to other software for computer modeling.

The special visualization (rendering) of 3D scenes of the software is very important. This is a visualization of three dimensional worlds by a two dimensional flat image. About the quality of the rendering, SketchUp accomplishes magnificent results. Most of the operations related to objects modeling are accomplished by modifiers which do exactly what their name means: modify objects. There are groups for selection, editing, animation, free from deformation, parametric, surfaces, transformation (conversion). SketchUp has different ready three dimensional objects – cylinder, cone, box, sphere, etc., that can be visually changed by all their parameters, can be modified and typical effects for the three main types of surfaces –mesh, patch and NURBS, can be applied on them, can be resized, rotated, textures can be applied on them as well [[4]].

In many cases the surfaces can be transformed from one to others and their specific ways of modeling can be combined. That way the learner has the opportunity to learn one of the standards from "Designing, planning and estimating" from the education content of the discipline "Home technics and economics", exactly "how to design products by working by instructions and models".

Another possibility for polygon modeling is the use of subdivision surface in mesh objects. Their technics divide the polygons in parts to receive smoother curves of the surface. That way the model composed of small polygons can be quickly built to get a model with higher resolution. Due to the bright lines applied in the technical education, it is important to focused on applicable aspects of the learning discipline. The development of uncomplicated constructions with SketchUp, the visualization of internal surfaces and models with cuts and sections gives students the opportunities to: estimate their own and foreign projects, make sketches and simple drawings of three dimensional

models, and that can build their visual intelligence and technological culture.

IV. CONCLUSION

The tendencies present one of the areas in which 3D modeling is unreplaceable helper in education. Realistic modeling three dimensional forms with the possibility for fast and easy searching of plastic and color solutions now have a real place in learning process. For that modeling must find permanent place in education programs in technological education of students, for facilitating their future realization. The ability for computer three dimensional modeling is intuitive, creative and it can easily be reduced to a set of instructions that the teacher can explain. With it the real practical work is developed and for that it is necessary to get to know it to use it in different disciplines in learning process to help the development of creative opportunities for the students.

During the time three dimensional computer modeling and creating of 3D-visualisation will no more be so expensive and will become more accessible and relevant to the needs of every one of us.

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Data processing of displacements between the ground and the point of cracking at the seven – story Van Nuys Hotel

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Abstract - One of the most complicated and powerful systems at planet earth is the Mother Nature. Almost every day, somewhere in the world, an earthquake is registered with magnitudes that affects life of many humans. It is very important to better understand the system of the ground shaking caused by sesmic waves. Collecting the data from these scenarios are very important for the researchers. We are processing the data from seven – story Hotel in Van Nyus, California during the Northridge Earthquake in 1994. During the earthquake, five instruments are measuring the displacements from the bottom to the top of the building. This paper represents the connection between the ground and the fifth floor at which the building is cracking. We will calculate some parameters that are important according to us between these two points and present graphically over the software LabView. Numerical solutions implemented via object – orinented blocks will give us the results that we are needed.

I. INTRODUCTION

One way to look at a signal is in the discrete time domain, which puts a series of values consecutively in time. In this way we can tell something about the behavior of the signal at every moment in time, and can also make some simple statements about its long-term behavior. However, it is rather difficult to say anything about how the long-term behavior is related to the short-term development of the signal. Another way to look at a signal is to view its spectral density (i.e., the Fourier transform of the signal). The Fourier transform views the signal as a whole. It swaps the dimension of time with the dimension of frequency. One can think of the Fourier transform as a combination of slow and fast oscillations with different amplitude. A very strong and slow component in the frequency domain implies that there is a high correlation between the large-scale pieces of the signal in time (macro-structures), while a very strong and fast oscillation implies correlation in the micro-structures. Therefore, if our signal represents values in every single moment of time, its Fourier transform represents the strength of every oscillation in a holistic way in that chunk of time.

A. The Building

This seven – story hotel in Van Nuys (VN7SH), California is one of the most studied buildings is southern California [2]. It has been designed in 1965 and constructed in 1966. VN7SH is located in central San Fernando Valley of the Los Angeles metropolitan area.

The building is 18.9 × 45.7 m in plan. The typical framing consists of columns spaced on 6.1 m centers in the transverse direction and 5.8 m centers in the longitudinal direction. Spandrel beams surround the perimeter of the structure (Figure 1). Lateral forces in the longitudinal (EW) direction are resisted by interior column-slab frames and exterior column spandrel beam frames [4]. The added stiffness in the exterior frames associated with the spandrel beams creates exterior frames that are roughly twice as stiff as interior frames. The floor system is reinforced concrete flat slab, 25.4 cm thick at the second floor, 21.6 cm thick at the third to seventh floors, and 20.3 cm thick at the roof.

The building is situated on undifferentiated Holocene alluvium, uncemented and unconsolidated, with a thickness of < 30 m, and an age of < 10,000 years [4]. The average shear-wave velocity in the top 30 m of soil is 300 m/s, and the soil-boring log shows that the underlying soil consists primarily of fine sandy silts and silty fine sands.

The foundation system consists of 96.5-cm deep pile caps, supported by groups of two to four poured-in-place 61-cm-diameter reinforced concrete friction piles. These are centered under the main building columns. All of the pile caps are connected by a grid of beams. Each pile is roughly 12.2 m long and has a design capacity of over 444.82 × 103 N vertical load and up to 88.96 × 103 N lateral load.

Fig. 1. View of Van Nuys Seven Story Hotel (VN7SH) from North-East.

TABLE 1. PROPERTIES OF THE CONSTRUCTION MATERIALS OF THE VN7SH BUILDING;
(1) Pounds per cubic foot
(2) Pounds per square inch
(3) Kips pers quare inch

Concrete (regular weight, 150 pcf [1])		
Location in the structure	Minimum specified compressive strength f_c' − psi [2]	Modulus of elasticity E − psi [2]
Columns, 1st to 2nd floors	5,000	4.2×10^6
Columns, 2nd to 3rd floors	4,000	3.7×10^6
Beams and slabs, 2nd floor	4,000	3.7×10^6
All other concrete, 3rd floor to roof	3,000	3.3×10^6

Reinforcing steel			
Location in the structure	Grade	Minimum specified yield strength f_y − ksi [3]	Modulus of elasticity E − psi [2]
Beams and slabs	Intermediate grade deformed billet bars (ASTM A-15 and A-305)	40	29×10^6
Column bars	Deformed billet bars (ASTM A-432)	60	29×10^6
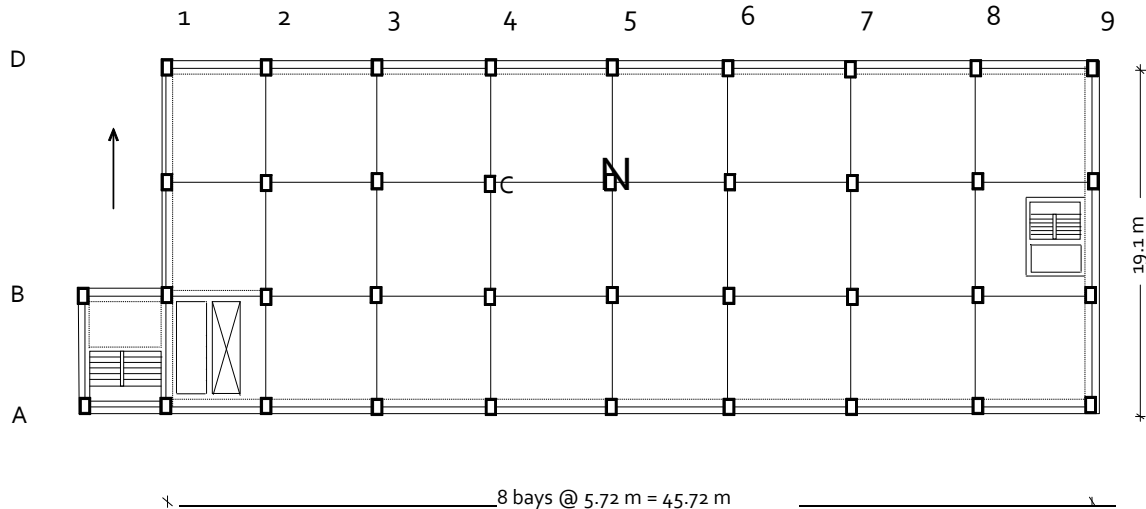
Fig. 2. Typical Floor Plan.

B.   The Earthquake Damage

The ML = 6.4 Northridge earthquake of January 17, 1994 severely damaged the building. The structural damage was extensive in the exterior north (D) and south (A) frames (figure 1) that were designed to take most of the lateral load in the longitudinal (EW) direction.

Severe shear cracks occurred at the middle columns of frame A, near the contact with the spandrel beam of the 5th floor (Figs. 1 and 2). Those cracks significantly decreased the axial, moment, and shear capacity of the columns. The shear cracks that appeared in the north (D) frame on the 3rd and 4th floors and the damage to columns D2, D3, and D4 on the 1st floor caused minor to moderate changes in the capacities of these structural elements. No major damage to the interior longitudinal (B and C) frames was observed, and there was no visible damage to the slabs or around the foundation. The nonstructural damage was also significant. The recorded peak accelerations in the building were 0.46g (L), 0.40g (T), and 0.28g (V) at the base, and 0.59g (L) and 0.58g (T) at the roof, along the longitudinal (L), transverse (T), and vertical (V) axes of symmetry (there were no sensors installed on the roof to measure vertical motions) [5].

During Northridge earthquake five transducers have measured the longitudinal displacements over the seven floors.

The response of VN7SH was recorded by a 13-channel CR-1 central recording system and by one tri-component SMA-1 accelerograph, with an independent recording system but with common trigger time with the CR-1 recorder.

The simplcitity, uniformity, and symmetry of the building geometry make this building ideal for testing and for calibration of different analysis methods. Instead of the common earthquake several damages, the Van Nuys damage is concentrated at the fourth floor which makes VN7SH very important for any kind of numerical analyse.

We use digital signal processing via Labview to get known with the crucial characteristics of a seismic excitation like one in California 1994. In a study of the propagation of non-linear waves in a simple, uniform shear beam, caused by incident strong motion pulses, Gicev and Trifunac [2] found that for large ground displacement pulses the maximum permanent strains in the beam occur mainly at the interface of the beam with the soil, while for smaller amplitudes of pulses permanent trains occur closer to the top of the beam. They identified three zones of the permanently deformed beam: (1) a permanently deformed zone at the bottom; (2) an intermediate zone, which is not deformed at its bottom part and is deformed in the top part; and (3) a non-deformed zone at the top of the beam. They found that the occurrence and the development of these zones depends upon the dimensionless excitation amplitudes and the dimensionless frequency of the incident strong motion pulses, and in particular on the conditions that lead to the occurrence of the first permanent strain.

Gicev and Trifunac [2] have also showed that for excitation by near-field displacement pulses, failure can occure anywhere in the building, before the incident wave has completed its first travel from the foundation to the top of the building and back to the foundation.

For large and long strong-motion pulses, only zones 1 and 3 are present in the beam. For large amplitudes and short strong-motion pulses, all three zones can develop and are present. For smaller excitation amplitudes only zones 2 and 3 exist in the beam.
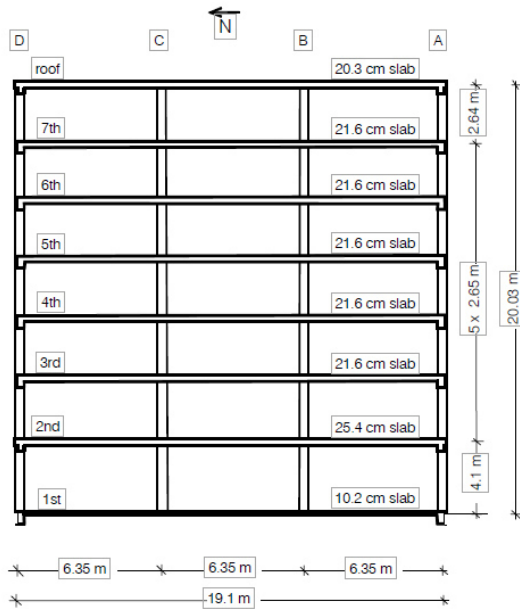

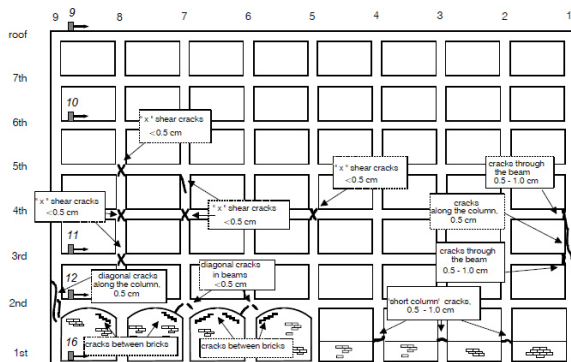Figure 1. North – South section of the building.

Figure 2. Observed damage at the north view of the building.

II. THE PHYSICS

A. Power Spectrum and Fourier Transform

In a study of the propagation of non-linear waves in a simple, uniform shear beam, caused by incident strong motion pulses, Gicev and Trifunac (2006) found that for large ground displacement pulses the maximum permanent strains in the beam occur mainly at the interface of the beam with the soil, while for smaller amplitudes of pulses permanent trains occur closer to the top of the beam. They identified three zones of the permanently deformed beam: (1) a permanently deformed zone at the bottom; (2) an intermediate zone, which is not deformed at its bottom part and is deformed in the top part; and (3) a non-deformed zone at the top of the beam. They found that the

occurrence and the development of these zones depends upon the dimensionless excitation amplitudes and the dimensionless frequency of the incident strong motion pulses, and in particular on the conditions that lead to the occurrence of the first permanent strain. For large and long strong-motion pulses, only zones 1 and 3 are present in the beam. For large amplitudes and short strong-motion pulses, all three zones can develop and are present. For smaller excitation amplitudes only zones 2 and 3 exist in the beam.

Spectrum represents a relationship represented by a plot of the magnitude or relative value of some parameter against frequency. Any one of the physicals phenomenoms has its own spectrum associated with it, either the phenomenom is thermal, hydraulic, electromagnetic, seismic or other.

The Fast Fourier Transforms (FFT) is an algorithm for calculation of Discrete Fourier Transform (DFT) of a input data vector [6]. In fact, FFT is DFT algorithm wich reduces the number of computations needed for N points from $O(N^2)$ to $O(N \log N)$ where log is the base-2 logarithm using periodicity and property. There are several algorithms that can calculate FFT efficiently.

Every phenomenom also has his own quantities and in our case that is time and displacement from longitudinal wave caused by seismic excitation. The quantites are described in time domain, and for every function of time $f(t)$, an equivalent frequency domain function $f(\omega)$ can be found that specifically describes the frequency – component content (frequency spectrum) required to generate $f(t)$. With other words, the power spectrum answer the question "How much of a signal is at a frequency ?". The periodic signal give peaks at a fundamental and its harmonics. Another way to look at a signal is in discrete time domain, which puts series of values consecutively in time. One can tell something about the behavior of the signal at every moment of time, and make a statements for its long – term behavior. But, it is difficult to say anything about how the long – term behavior is related to the short – term development of the signal. The Fourier transform views the signal as a whole. It swamps the dimension of time with the dimension of frequency. It can be thought as a combination of slow and fast oscillations with different amplitude. A very strong and slow component in the frequency domain implies that there is a high correlation between the large – scale pieces of the signal in time (macro – structures), while a very strong and fast oscillation implies correlation in the micro-structures. So if we consider that our signal $f(t)$ represents values in every single moment of time, its Fourier transfor

$f(\omega)$ represents the strenght of every oscillation in a holistic way in that chunk of time. Each of the two signals are related to one another with the formula:

$$F(\omega) = \int_{-\infty}^{\infty} f(t)e^{-j\omega \tau} dt \qquad (1)$$

In our case Labview functions for FFT – based signals are the FFT, the Power Spectrum, and the Cross Power Spectrum. With these functions also can be created aditional measurement functions such as frequency response, impulse response, coherence, amplitude spectrum, and phase spectrum. The Fourier transform analysis assumes the life of a signal from $-\infty$ to ∞. Because of that, when an analysis is carried out for a finite amount of time, it is either assumed that the signal is periodic or that it has a finite amount of energy. The true power spectrum of a signal has to consider the signal from $-\infty$ to ∞. But we must consider that we are not always able to observe a signal that way or derive precise functions for it. Virtual instrumentation software is focused on the needs of the aplication and user defined. Applied mathematics is combined with real – time measurements, wich reduce the time for innovation and also importantly the time to market and/or time to commercialization of the final products and services that result from research and development using virtual instrumentation approach.

III. LABVIEW RESULTS

The measured displacements from the seismic exctitations are longitudinal displacements in matter of time. We collect data from five instruments (channels) shown on Figure 2 (09, 10, 11, 12, 16). Channel 16 is at the basement of the building and channel 09 is at the roof of the building. Analog to this, the displacement is most significant at channel 09. We construct program in Labview to graphically see these displacements. The program has reader of the data files shown od figure 3.
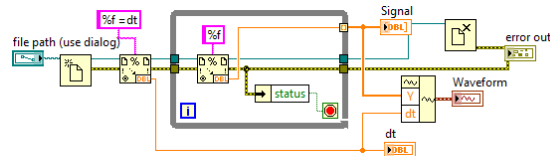

Figure 3. Block Diagram for data reader for each of the channel measurements

Important to mention is that the measurement is with time of 60 seconds and time step $dt = 0.02$. That mathematically gives 3000nd steps. The time step is defined at the start of each of the measurement files, so, we make a scan function to collect dt and through while-loop build a waveform.
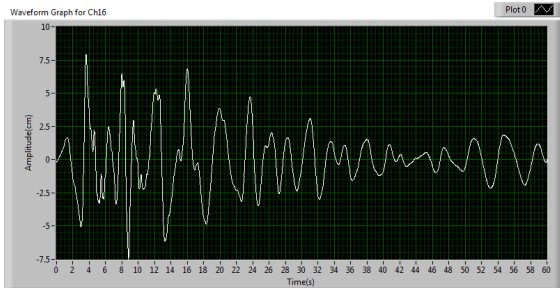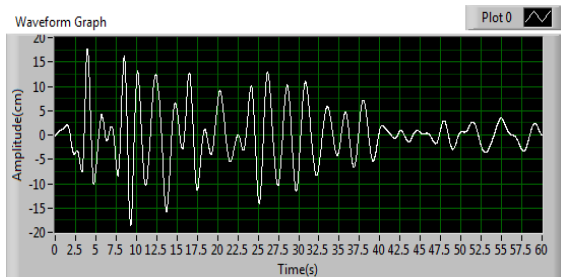
Figure 4. Displacement in matter of time for channel 16 (x-scale represent the time(s), y-scale represent the displacement (cm)).

If we analyse the waveform graph we can see that in first 24 seconds the amplitudes are high and are going from 5 to 7.5 centimeters.

From the channel 16 to channel 10 the amplitudes are continuosly groing and at channel 10 they are highest. So because we are interested mostly of that what is the difference between the basement channel and the roof channel, on figure 5 is represented the displacement at channel 10.

Figure 5. Displacement in matter of time for channel 10 (x-scale represent the time(s), y-scale represent the displacement (cm)).

From figure 5 can be seen that the displacement is significantly bigger and from 0 to 38 second is between nearly 8 to 20 centimeters, that gives us a clue that, metaforically said, the roof of the building is shaking for 20 centimeters. Important to mention is that these displacements looked from seismic angle are far more complex, and are illustrated in [2].

Next processing that interests us in this paper is the FFT of these signals.

The figure 8, waveform graph for channel 16 represent also FFT at displacements in the basement and prove that with smaller displacements there are smaller magnitudes, or, in case of ch16 we have 0.9 magnitude at frequency of 0.28Hz. The transfer
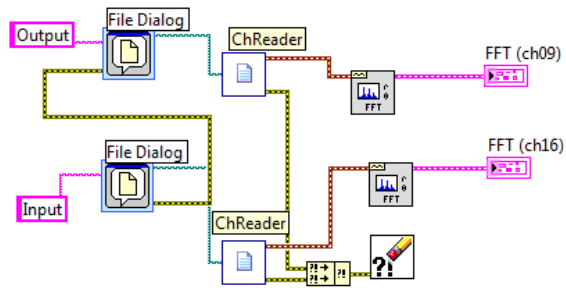
Figure 6. Blog diagram for Simultanuosly reading the two cannels with FFT signal processing

On figure 6 one can see that there are two channel readers connected with FFT spectrum for magnitudes of the signals. There are also two file-dialog boxes connected on the channels, and two waveform graphs denoted as FFT(ch10) and FFT(ch16).

The figure 7 and figure 8 represent the FFT of the channel 10 and channel 16 consequently. Now if we take a close look at waveform graph of channel 10 (crack point) we will see that for higher displacement we get higher magnitude. The highest peak is at nearly 0.44Hz at magnitude of 3.3.
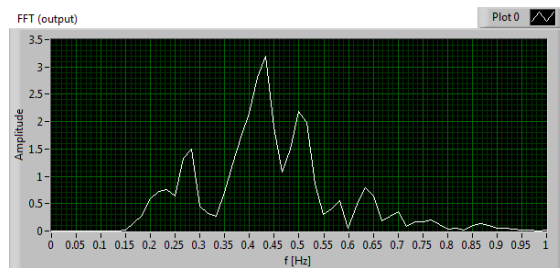
Figure 7. Waveform graph for FFT of channel 10 with x-scale frequency and y-scale magnitude.
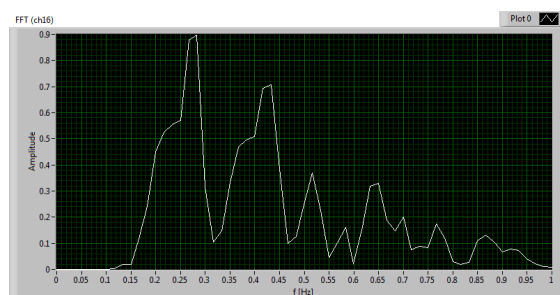
Figure 8. Waveform graph for FFT of channel 16 with x-scale frequency and y-scale magnitude.

function represents the ratio of the output of a system to the input to the system, in the Laplase domain considering its initial conditions and equilibrium point to be zero. If we have an input

function of $X(t)$, and an output function $Y(t)$, we define the transfer function $H(s)$ to be:
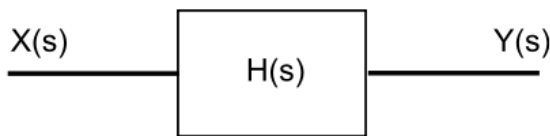
$$H(t) = \frac{Y(t)}{X(t)} \qquad (2)$$

Figure 9. Input X(s) and output Y(s) of a tranfer function H(s).

The transfer function of a system is the relationship of the system's output to its input, represented in the complex Laplace domain.
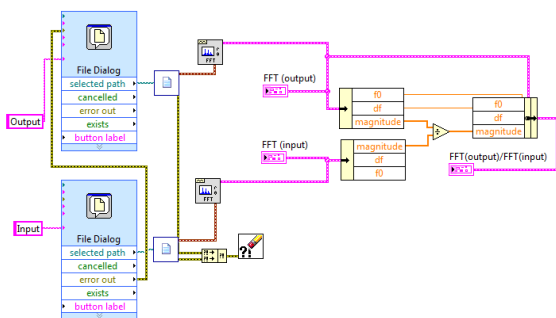

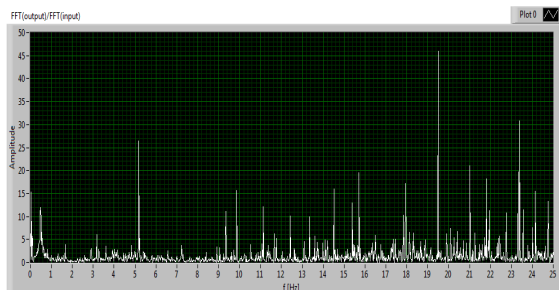Figure 10. Blog diagram of H(t) transfer function via Labview

Figure 11. Waveform graph for H(t) transfer function

Figure 10 represent the block diagram for H(t) transfer function, the two channel readers gives the signals to FFT(magnitude) and we divide the output from the input in a waveform graph, figure 11. From the waveform graph we can see what's like the impusle response of this particular building or the natural frequency of the building. The highest amplitude peak is at nearly 4.5Hz with is crucial in case of a seismic excitation with that proportions.

IV. CONCLUSION

For past three of four decades, scientists are giving efforts on predicting some natural disasters. The fact is that, we still don't know all of the characteristics of these natural excitations, but we can prepare better for them, if we know closely the effects of these disasters in matter of their power. In our case we speak about seismic excitation that has result with damage to the VN7SH.

With power of numerical methods, mathematical transformations and software digital processings, we can be a little more aware of what kind of damage would be, in scenario like in California 1994. Every building has its own natural frequency. Sometimes it is very important to know this frequency because some buildings are used as fabriques that have some oscilating mashines and it can be of cruical importance where in the building will these mashines will be located. Our purpose is to take measurements of the buildings and tell to their builders little more informations of that how will that building act in worst-case scenario.Normally this field of investigation is improving more and more, with powerful tools like Labview which is used for these signal processing.

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One Supervisory System Solution for the Protecting of Public Facilities

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Abstract - This paper presents one realized solution to the surveillance signaling system for the protection of the "Čair" Sports Hall in Niš. Technical solutions applied in the reconstruction and renovation of the hall are explained in detail. The applicability of the presented solutions and other public facilities is pointed out. The implementation of the presented solutions in the process of adaptation of old and the construction of new schools is proposed in this paper.

I. INTRODUCTION

The automatisation and control of electro-energetic installations and surveillance systems is the trend in modern installation systems. Paper [1] explains one centralized supervisory system and gives an integrated solution for easier and more economical management of premises. This paper offers detailed technical solutions of the anti-burglary system, approach control system, video supervising, ticketing system, automatic fire detection and alarm signalisation and also alarm central as parts of an integrated surveillance signaling computer controlled system.

II. SUPERVISING SIGNALISATION SYSTEMS

Advantages of modern centralized system for monitoring and control are:

- Centralized view of control of all systems in object;
- Integration of all systems which demand control;
- United management over all supervising control systems;
- Reliance;
- Automated increasing of efficiency;
- Remote control and mobility;
- Reducing of future investments;

- Better view of the situation;
- Energetic efficiency;
- Planning.

Detailed analysis of these advantages is given in the paper [1].

As we say supervising signalization system we think intrusive alarm system, system for approach control, system for video supervising, ticketing systems and system for fire protection. Each system has its own server and data base. The complete ruling over all systems is centralized by one or two computers depending on demands of user.

From the fire protection central station, security alarm system control of approach, central system for video supervising, only status and alarms are taken. The central system for supervising and ruling collects information from all systems as well as from all controllers and makes one whole.

A. Intrusive alarm system

This alarm system works as a preventive to people and properties in object and in the case of intrusiveness there are sound and light signalization as forwarding the alarm signal through the phone line. This scenario is related to period when object is closed, when there is nobody and also for the areas which need protection regardless of time.

Al entrances in object are covered by passive infrared and mixed microwave – infrared detectors of movement in combination with magnetic detectors of door position (open-close) so this covering of entrance is much more reliable. Detector of movements reacts on movement in covered areas (inside the object, around the door) while magnetic contact signs to central station when the door is out of the position "closed".

All glass surfaces have detectors for breaking which works by the principal of sound (frequency) of breaking glass. In this case also is present the redundant system by placing detector of movement in combination.

An installation of system is projected as combination of addressable – conventional system. The informers are predicted as conventional, while the other elements (centrals, expanding modules, encoders) are addressable elements. By this concept the clearness of installation is accomplished in the sense of keeping up and supervising (sectional dividends of elements) [2].

B. System of approach control

The control of approach is realized at the places where there is a need to control the entrance, in fact in the exact functionally divided section of object. Here is, by reading of proximity card, in case of permitted approach, an opening of electromagnetic lock at the door. Magnetic contact at the door is supposed to sign the opening of the door (open – closed) at any moment. The elements of this system are:

- controller of the approach;

- scanner for proximity card – transponder;

- magnetic contact at the door;

- electromagnetic lock;

- REX taster (for opening the door from inside).

This system is supposed to enable connection with software for control and ruling

C. Video supervising (CCTV)

The system of video supervising enables to physical security, doorman, and persons of duty to supervise the critical spots in or around the object from the aspect of security. Besides, this system enables constantly recording and review of recorded material. This system is predicted to do all the function of video supervising: detection, recognition and identification.

The chosen technical solution is net type (IP) which contains IP camera, net POE switches, devices for recording video material and software for supervising and ruling the system.

By this project video supervising is predicted to be above the entrance, over perimeter of object, the main communications stands, playground and the other sensitive areas.

The cameras above the entrance in to the object (personal identification) also at the places where huge covering is needed (stands, fields, areas around object) are of resolution – 1,3mpx (Fig. 1), while the cameras for monitoring are of resolution – 1mpx ore VGA, by respect (Fig. 2).

Figure 1. Camera above the entrance [3]

The movement detection and the alarm entrance enable activation of cameras by changing the picture or elements of alarm system.

SDHC slot enables recording (viewing) of video directly in to SDHC card which is in the camera. Recommendation is SDHC cards, class 6.

In each distributive locker the net device is predicted (POE switch) for connecting cameras and which is related to main commutative device ("core" switch) and NAS (Network attached storage) for recording. These devices are approached over net communication protocol from the local net (LAN) or from the distant location (by internet), and

adequate protocol (http, ftp).

Figure 2. Camera for monitoring [3]

The cables for digitalized video signals are type: F/UTP 4x2xAWG23 cat 6 (it is the part of structural cable system), and they are power suppliers for cameras (Power over Ethernet).

D. Ticketing system

There are 14 lines for visitors with tickets installed.

Each line contains:

- input tripod barriers with bar code scanner and signalization (Fig. 3);

- exit winged door (Fig. 4);

- controller connected with all devices which is in the net by cables with server

Figure 3. Input tripod barriers [3]

All devices are connected with structural cable system to Ethernet. The system is running by server with data base and application for ruling and control (Fig. 5).

E. Automatic detection and fire signalisation

This project is predicted as an analogue addressable system for automatic detection and fire signalization in the whole object. The function for protection is accomplished by smoke detection on time, fire or high temperature at the early phase of fire or by alarming people in object and fire station so that people can be evacuated and property protected. Detection on time considers the shortest time from the beginning of the fire and action of extinguishing a fire which can be accomplished by choosing automatic detector for fire and regular schedule in all part of object depending on the level of fire risk. Detection system it self and system for fire signalization do not fulfill at all their demands if there is not adequate equipment and devices for extinguishing as well as people's training.

System for detection and fire signalization contains:

- analogue – addressable alarm central station;

- analogue photoelectric informers of fire (smoke detectors);

- analogue thermo maximal/thermo differential informers of fire;

- analogue combined (thermo – optical) informers of fire;

- manual fire informers;

- addressable I/O modules for activating the functions;

- addressable modules for extending system by conventional areas;

- alarm devices (sound and light);

- cable distribution which connect all these devices;

- power supply of system by voltage 230 VAC and reserve battery voltage 24 VAC.

Figure 4. Exit winged door [3]

F. Alarm central station

Central station for automatic detection and informing of fire is microprocessor type – analogue addressable, and it contains these elements:

- mental-plastic box;

- 4 lines / loops;

- programmable non-voltage contacts (230 VAC);

- programmable voltage contacts (transistor output) (24 VDC, min 1A);

- transistor output sirens (24 VDC, min 1A);

- LCD display;

- zone LCD indicator;

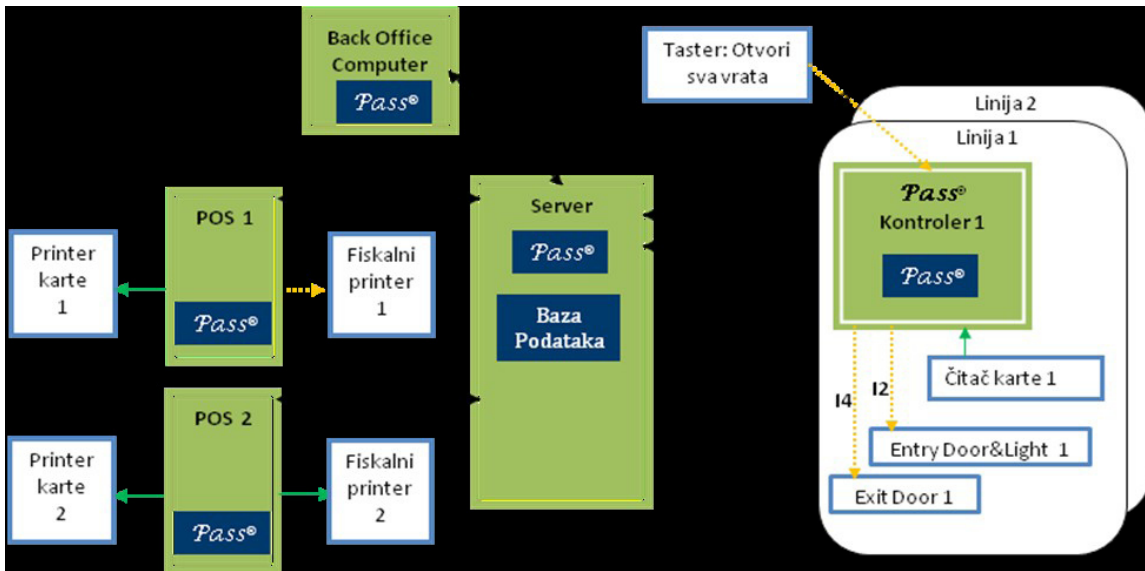influences dimensions and shape of areas, height

Figure 5. Block scheme of the "Čair" sports hall entrance management application [3]

- functional tasters;
- memory of events;
- modem – phone alarm informer;
- AC/DC grid and reserve battery power supply.

G. Addressable elements –fire informers

By automatic fire detectors all areas in the object are covered except wet knot. To choose the type detector there are real and possible influences: expectable earlier fire measures, disrupted

Figure 6. Alarm central station [3]

and shape of ceiling or roof, streaming of air, temperature oscillation, dispose of elements of non-electric installation etc. The number of detectors in each area depends on fire risk, height of area and supervised areas.

In the most of areas there are predicted optical (photoelectric) fire detectors, considering that the smoke is the first to appear in the earliest phase of fire. In the basement there are predicted the optical smoke detectors in the area with lower ceiling, with LED indicator which is placed just under detector, into a lower ceiling.

Thermo detectors (thermo maximal/thermo differential) are predicted in the areas where it can be disrupted influences to photoelectrical – optical detectors (dust, moisture, air streaming, evaporations etc.) – kitchen, machine room and similar. In the kitchen it is supposed to activate thermo maximal function of detector and move it away from the heaters.

In the technical areas (areas with switch boards, telecommunication areas) as well as in workrooms where are predicted combined fire informers (smoke/temperature).

On every exit on from clime chambers there are predicted smoke sensors in chamber for air sampling from clime canals, because of appearance of smoke or fire in clime chamber it self (ventilator damage or similar).

For alarming the fire danger in object there are predicted manual fire informers to alarm manually, infect alarm of first degree. Manual informers are distributed along communication/evacuation ways, at all exits of object, of all exits from flats and near the stairways also near the areas with high fire risk and areas with crew.

III. THE IMPLEMENTATION OF THE PRESENTED SOLUTIONS IN SCHOOLS

The project of reconstruction of the"Čair" sports hall is realized with the aim of adjusting facilities with both national and international standards and conditions for practicing sports [4], [5]. Economic motive and the provision of conditions for the employees to work and earn money have all been the reason for initiating the realization of such a detailed and expensive project.

During the project, special attention has been paid to the safety and the protection of both the premises and the people, which is shown with the technical solutions presented in this paper. The realized solutions, from their technical and technological aspect are universal and as such are used in the protection of other facilities as well. The development of the consumer society in our country has led to the weakening of the financial capabilities, the decrease of moral and family values and the education of children were all shown in [6]. Apart from burglaries, adolescent delinquency is also increasing in schools and school yards [7]. Not only can the presented solutions help protect property, but they can also significantly help protecting our children and keeping them safe, which certainly is of utmost importance. Regardless of material costs, the use of the presented methods

and technical solutions is strongly recommended during the process of reconstructing old and building new schools with the aim of achieving better protection of the health and the lives of our children.

IV. CONCLUSION

Central managing of sports facilities has been dealt with in this paper as well as program support tasks and the advantages that they include. One solution of centralized supervision signaling system used for the protection of both facilities and people, realized within the project of the reconstruction and adaptation of the "Čair" sports hall in Niš has been presented in detail in this paper. The implementation of the presented technical solutions in school facilities with the aim of protecting property, but more importantly for the purpose of increasing the safety of children and the protection of their health and their lives has been recommended.

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Integration of Abbott Standard Interface Communication Protocol, the Hospital Information System

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Abstract - Information Communication Technology (ICT) has increasing use and importance in medicine. In order to develop software CLSI Analyzer v1.0.1, aimed at the integration of Abbott Standard Interface (ASI) communication protocol in the Hospital Information System (HIS), we used the Microsoft .NET Framework V3.5 software environment. In this paper, we created a model and tested the software on the local network. The possibility of improvement in the software is based on .NET programming environment. Directions of improvement are seen in: development of intuitive interface which would be oriented toward the actual user needs and increasing levels of automation software applications in the area of creating messages about Abbott Standard Interface.

I. INTRODUCTION

Hospital Information System (HIS) is a set of mechanisms and procedures which aim to ensure the collection, analysis and dissemination of information necessary for planning and management of the hospital, to provide all types of health care research in the health system and training health workers [1].

Today, clinical and administrative data are very complex and different in medicine. The number of annual clinical evaluations, technical and scientific papers is 100 times greater than 30 years ago, or last 5 years represent 49% of the total number of papers in peer-reviewed scientific journals [2].

However, in spite of such expansion there is still a large gap between the requirements of sustainability and the possibilities of the health system (Figure 1) [3]. One of the segments of a complex solution to reduce this gap is the increasing use of information communication technology (ICT).

Today, health care system use mutually incompatible information systems and application solutions, and there is a lack of vertical (within a health institution) and horizontal (between different health care institutions) linkages of entities and health systems. Using the model for the integration of medical devices in the HIS reduces the gap between requirements and capabilities of the health system [4].
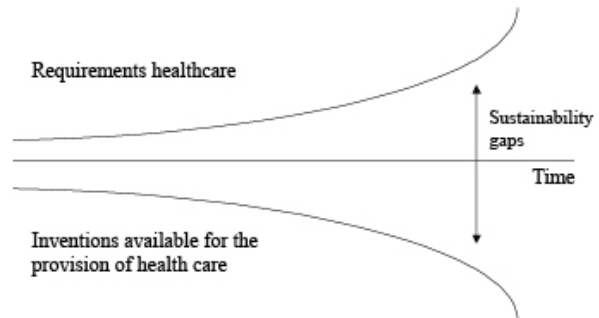

Figure 1. Sustainability gaps between requirements and capabilities of health care

Abbott Standard Interface (ASI) is a communication protocol of the medical device manufacturer Abbott Laboratories, which holds 14% of the total world market [5].

Software environment chosen for the development of software applications for the integration of ASI communication protocol in the hospital information system is Microsoft. NET - programming environment with its standard libraries. It allows encoding the program once, without re-writing the code, and their work on many desktop computers and installed operating systems.

II. AIM OF WORK

Exchange of data between medical devices and hospital information system using communication protocols ASI.

III. MATERIAL AND METHODS

Elements used in the local network are:

- clinical and biochemical analyzer Abbott Architect ci8200,
- computer,

- communication channel consisting of:
- convertor USB/RS-232 DB-9 Rotronic Logistics D-76275,
- null-modem.

Communication with external computers, Abbott devices by ASI communication protocol maintaines through the DB9 connector which is classified as Data Terminal Equipment (DTE), with active pins 1 (DCD), 2 (TxD) 3 (RxD) and 5 (GND).

Software package used to test the Integration of ASI communication protocol into the HIS, was created in Microsoft. NET Framework V3.5 programming environment and programming language C #.

ASI protocol is based on the OSI (Open System Interconnection) reference model compatible with industry-supported protocols in a series of standards LIS of international organization CLSI (Clinical and Laboratory Standards Institute): LIS1-A, lower level protocol, and LIS2-A2 protocol of higher level.

According to the ASI protocol messages are composed of records, and records of the fields in which the data is entered. In the ASI standard data and messages are consistent with the LIS1-A standard, while the record is consistent with LIS2-A2 standard. According to the LIS1-A standard messages can be sent as one or more frames, depending on the length of messages, where the frame is a part of the message that allows the

transfer of 247 characters, of which 240 characters of data, and 7 are control characters. Maximum frame rate is 8, and they are marked with a digital number from 0 to 7 [6].

ASI defines the following architecture of protocol layers:

1. Physical Layer - defined by standard LIS1-A paragraph 4;
2. Data Layer – defined by standard LIS1-A paragraph 5, and consists of the establishment phase, phase of transfer, and completion phases;
3. Presentation Layer – defined by standard LIS2-A2;
4. Aplication Layer

During the testing of software package within the local network, the behavior of applications in accordance with the requirements of ASI communication protocol was followed.

IV.   RESULTS

Model of integrating ASI communication protocol in the hospital information system includes a computer, communication channel, and chemical-immunological analyzer Abbott Architect ci8200 (Figure 2). On a computer there is installed designed software package CLSI Analyzer v1.0.1.
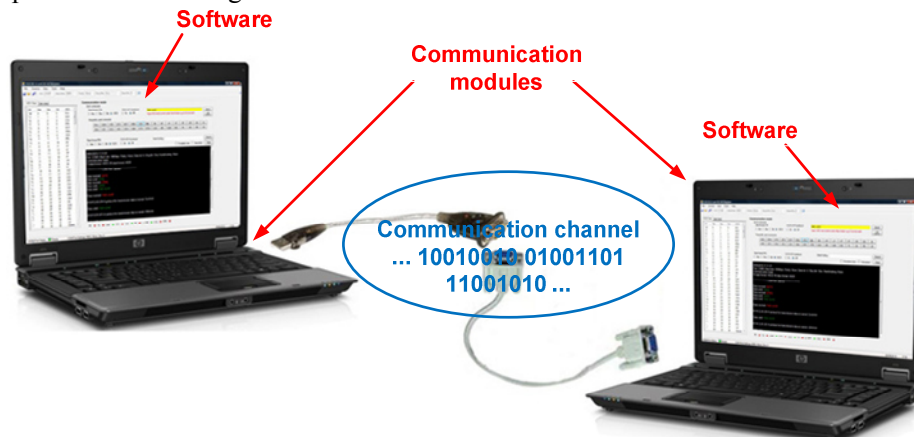

Figure 2. Model of integrating ASI communication protocol in the hospital information system

For ease of software testing an optional platform was created in the CLSI Analyzer which allows operation in the mode of device Abbott Architect ci8200.

CLSI Analyzer software package is designed for the archiving of data within the control computer workstations of hospital information system and provides:

1. receiving and sending data through the communication channel;
2. control of a status of connection pins
3. monitoring the process of sending and receiving data over the working terminal;

4. choice of data visualization in the terminal work in hexadecimal, decimal, binary and ASCII format;

5. creation, preservation and correction of created messages

6. archiving of records of communication flow;

7. view of received messages;

8. archiving data in a database.

Data transfer is carried out through a communication channel with characteristic signals that define the essential structure of the sequence:

start bit with value 0, the character data of 8-bit and stop bit with a value of 1. In the dependence of the length of the channel is the data rate that can range from 1200-115200 bit / s.

Figure 3 shows the appearance of the CLSI Analyzer interface. During all phases, establishment, transfer and finishing there are certain rules and time limits for the expected response. If a discrepancy occurs the application will report an error according to the ASI protocol. All communication that takes place is shown in the work terminal which prints all data that can be usefully during the data transfer.
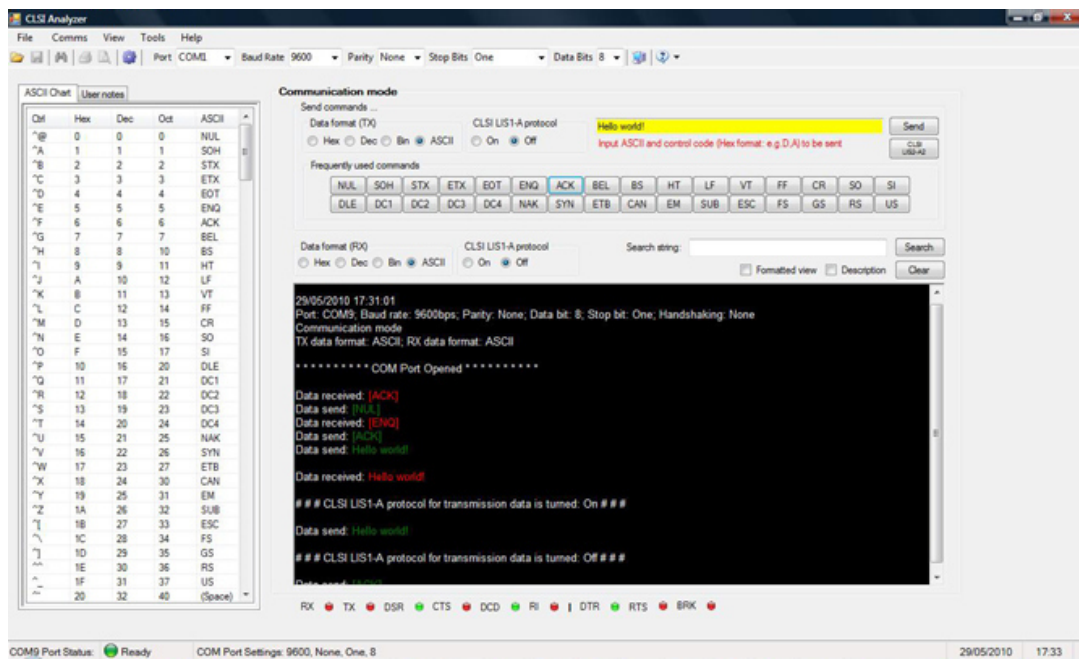
Figure 3. Application interface CLSI Analyzer v1.0.1

Phase of the establishment initiates element that has prepared information for sending, and it is sent by a special character messages <ENQ>. During this phase, the only valid characters are <ENQ>, <ACK> and <NAK>, while all other characters are ignored.

Phase transfer is characterized by the transmission frame data along the communication channel, and the maximum number of transmission attempts of the same frame of data is limited to seven repetitions.

Composition and distribution of data is according to the requirements of LIS1-A standards, paragraph 5, that adds 7 control characters to the data frame.

CLSI Analyzer application provides sending the framework of data to the requirements of the LIS1-A standards (Figure 4), which includes, in addition

to data frames, all control characters including characters intended to verify the correctness of messages, most significant character of checksum (CS1) and the least significant character of checksum (CS2).

End stage is characterized by sending a special character of message <EOT> by the sender that the recipient is notified about the completion of the transfer of messages. Figure 5 represents the ability to create posts in accordance with the requirements LIS2-A2 standard within the application CLSI Analyzer. Messages can be saved in XML format and for this purpose is the SQL database.
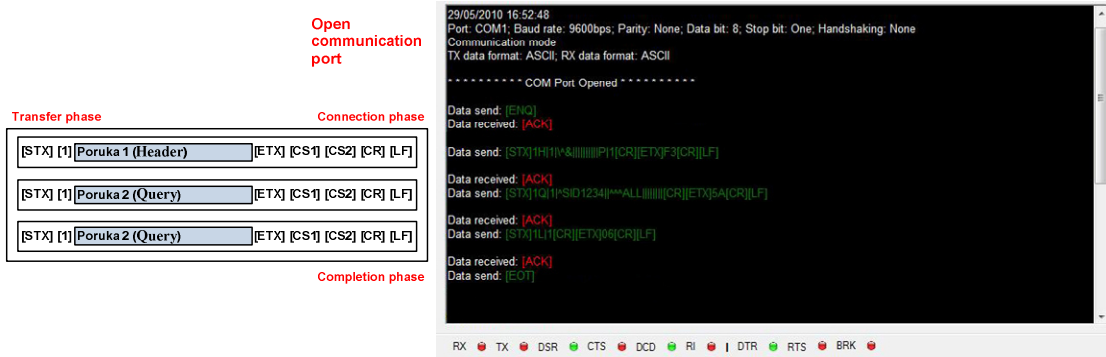
Figure 4. The frame of data to the ASI protocol and its view in the working terminal of application CLSI Analyzer

V. DISCUSSION

In the late 80's the standardization of messages, that are exchanged between different information systems in health care was introduced. The purpose of standardization of messages is to establish an integrated information system, which integrates heterogeneous subsystems resulting in different places from different manufacturers and from different purposes. The goal of standardization and integration of heterogeneous messaging systems is to achieve optimal functioning of the subject of the health system.

Today, in medical informatics, there are several standards such as the DICOM, HL7 and POCT.
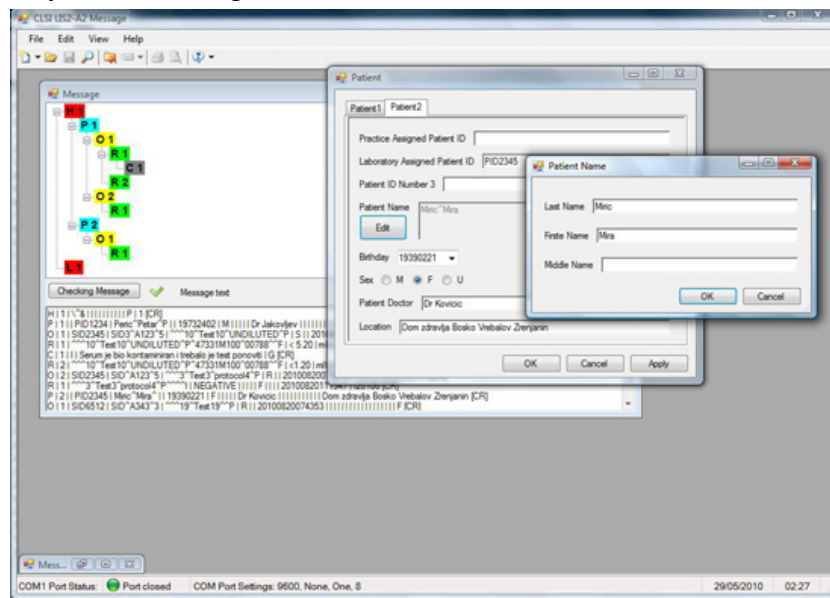
Figure 5. Creating a message in the application CLSI Analyzer

DICOM (Digital Imaging and Communications in Medicine) standard states the exact procedures under which the digital images are sent between devices, whether to use the network connection or a storage device. DICOM for still images use JPEG format and for video is accepted MPEG-4 [7] [8].

HL7 (Health Level Seven, 7th OSI layer protocol) and POCT1-A (Point-of-care testing) are standard protocols for electronic exchange of information among health care applications of the seventh layer of the OSI model .

International Organization Group HL7 (HL7 Group) in 1987. published a first version of HL7 standards. Over the years of development, this standard has had their amendments so they created versions: 2.1, 2.2, 2.3, 2.3.1, 2.4, 2.5, 2.5.1, 2.6 and 3. All versions that preceded HL7v2.5 used the ASCII encoding and delimiter, and version from 2.5 used XML format.

The latest version of this standard is based on HL7v3 RIM (Reference Information Model) model. This model has been accepted by ISO and has the mark ISO/HL7 21,731 [9]. CLSI in 2002. publishes

standard POCT1-A designed for two-way communication of POCT (Point-of-care testing) devices with hospital information system [10]. Today, the current version of this standard is POCT1-A2 and all the messages in this standard are text base and exchanged in XML format.

This standard defines two interfaces, Device Interface that allows the flow of information from devices to controllers and Observation Reporting (Electronic Data Interchange-EDI) Interface (ORI), which allows writing messages between the controller and receiver. The basic two parts of Device interface are: low-level protocol, designed for connecting devices and access points, Device and Access Point Interface (DAP), and higher-level protocol intended for communication between devices and controllers, Device Messaging Layer (DML) [11].

DML for data encoding and elements of information models use the rules defined in HL7v3 standard, while ORI is based on the implementation of HLv2.4 standards. DAP is based on the rules of ISO / IEEE 11073-30200, which refers to the part of Transport profile - Cable connected and ISO / IEEE 11073-30300, which refers to the part of Transport profile - Infrared wireless [11].

The problem of communication between devices that apply different standards becomes more visible today. Most commonly applied standard of health information systems is HL7.

The results of testing the model intended for the integration of ASI protocols in hospital information systems point to a successful exchange of data and the possibility of their filing in the SQL database control computer workstations. The data archived in the control computer workstation can still be used independently on the type of communication protocol within the hospital information system.

VI. CONCLUSION

The integration of ASI communication protocol in the hospital information system by applying the created model is possible. By conjunction of created software package, CLSI Analyzer, and applied hardware we provide receiving and sending data using the ASI protocol. CLSI Analyzer software package v1.0.1 is created in Microsoft. NET environment, while SQL database was used for the purposes of archiving data.

Directions of improvement are seen in:

- developing an intuitive interface that would be oriented toward the real user needs

- increasing levels of automation of software applications in the area of creating ASI messages.

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Learning Management System Moodle in Health Care

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Abstract - Modern information communication technologies enable health care organizations to manage accessible learning of their employees. Today there are number of learning management systems on the market. Some of them are commercial; others are freeware - open source and there are learning management systems that operate in the cloud. The advantages of learning management system compared to traditional learning are multiple. It provides a broad set of functionalities, reduces costs, accelerates the educational process and directly or indirectly contribute to a higher level of quality of service. Currently, the most popular learning management system is Moodle.

The aim of this paper is to describe Moodle and to explore for which purposes Moodle can be applied in the health care and what benefits it brings.

Department of education and scientific research in our institution created a knowledge management system which manages knowledge from documents generated inside the institution. Furthermore, we implemented learning management systems Moodle as a complementary solution.

In the study we used narrative review method. We performed a comprehensive search through MEDLINE and ResearchGate. We also examined the official Moodle documentation.

Opinions expressed in the review are also based on personal experience as authors, medical workers and IT professionals. After reviewing the current literature, we concluded that Moodle can be successfully applied in health care organizations for education and training of healthcare professionals, as well as in medical Schools for students..

I. INTRODUCTION

In addition to the well-known traditional classroom learning, there are basically three ways of learning: distance learning, e-learning (electronic learning) and blended learning.

Distance education or distance learning is a way of learning remotely without being in regular face-to-face contact with a teacher in the classroom. It is a feasible option for students unable to attend traditional classes. Distance education originally began in the form of the earliest correspondence schools in the eighteenth century and grew in popularity over the next few decades.

E-learning is a relatively new educational alternative to correspondence-style distance education, thanks to our technological advances. It could be a substitute or an upgrade to the existing distance learning program. According to Gartner:

"E-learning is the use of Internet technology for learning outside of the classroom. E-learning suites are software solutions that enable automation, administration and training over the Internet. E-learning suites are integrated product collections that comprise learning management systems (LMSs), virtual classrooms, courseware and learning content management systems (LCMSs). An LMS is software that automates the training process and function and includes registration and administration tools, skills and records management, courseware access, and programming interfaces to packaged applications. An LCMS is an integrated set of technology that manages all aspects of learning content. This includes authoring or acquisition, content history, auditing, replacement, and deletion. An LCMS generally works in conjunction with an LMS [1]".

E-learning could be divided into 3 categories: text Driven, interactive and simulation training or simply simulation. Simulation trainings are very popular nowadays because they allow individuals to learn and practice real world activities in a safe, highly realistic and secure online environment. 3D serious games are typical training simulations that provide both time and cost savings.

The terms "blended learning," "hybrid learning," "technology-mediated instruction," "web-enhanced instruction," and "mixed-mode instruction" are often used interchangeably in research literature.

Blended learning is a formal education program in which a student learns at least partially through delivery of content and instruction via digital and online media with some element of student control over time, place, path, or pace. While students still

attend "brick-and-mortar" schools, face-to-face classroom methods are combined with online learning experiences. The online and in-person learning experiences would parallel and complement one another.

Learning could be also divided into synchronous and asynchronous. The idea behind asynchronous learning is that students learn the same material at different times and locations. Synchronous learning is where students learn at the same time by activities such as attending a lecture or laboratory. Modern information communication technologies create conditions for asynchronous learning and enable organizations to manage accessible learning of their employees.

Today there are number of learning management systems on the market. Some of them are commercial such as: digitalchalk, absorbLMS, grovoLMS, axisLMS, Edmodo LMS, blackboard(former webCT); others are freeware - open source such as: Claroline, ETutor, eFront, ILIAS, CanvasLMS, Dokeos, ATutor/Acontent, Sakai, Moodle, and there are learning management systems that operate in the cloud such as: Talent LMS, Learn.com, eCollege, Adobe Captivate Prime, CourseMill, Docebo, Litmos and others.

Division between free and commercial systems is not so clear, so it may happen that some system is provided free of charge in its primary raw variant, while being fully charged for its customized version when it is completely adapted to the user's needs.

There are even themes and plugins for the WordPress that can easily transform website or blog into full featured LMS. Popular WordPress LMS themes are: Academy, eLearning WP, WPLMS, Clever Course, Masterstudy, Guru, iKnow, University and others. Popular WordPress plugins are: Learndash, Learnpress, Namaste, Sensei and others.

The advantages of learning management system compared to traditional learning are multiple. It provides a broad set of functionalities, reduces costs, accelerates the educational process and directly or indirectly contribute to a higher level of quality of service. Currently, the most popular learning management system is Moodle.

II. Methods

In the study we used a narrative review method. We performed a comprehensive search through

Medline, and ResearchGate using the following key phrases: moodle in healthcare, moodle for learning healthcare, learning management systems for health, moodle in medicine.

In the data collecting phase, a total of 39 articles were gathered, 17 of which were assessed for inclusion or omission of key issues and from among these, 11 articles were in focus of our research. Articles in which it was possible to see the practical application of Moodle as well as the benefits realized in health care were of the greatest interest to us. These were carefully scrutinized. The background research was done using the Gartner and Capterra. Opinions expressed in the review are also based on personal experience as authors, medical workers and IT professionals.

III. Brief Description of Moodle

Moodle is a learning platform created to provide educators, administrators and learners with a single robust, secure and integrated system to create personalized learning environments. Moodle is built by the Moodle project which is led and coordinated by Moodle HQ, an Australian company of 30 developers which is financially supported by a network of over 60 Moodle Partner service companies worldwide. Moodle is a free, online Learning Management System, written in PHP and under the GNU General Public license. Moodle is used for blended learning, distance education, flipped classroom and other e-learning projects in schools, universities, workplaces and other sectors [2]. The word Moodle is an acronym for Modular Object-Oriented Dynamic Learning Environment. Moodle is supported by an active network of certified Moodle Partners to assist with support, and an active community of developers, users and supporters [4].

In the text that follows, we will present technical specifications for Moodle 3.0.

Hardware requirements: Disk space: 200MB for the Moodle code, plus space for content. (5GB is probably a realistic minimum). Processor: 1GHz (min), 2GHz dual core or more recommended. Memory: 512MB (min), 1GB or more is recommended [5].

Moodle runs without modification on Linux and Windows operating systems that support PHP

 (minimum PHP 5.4.4) and a database including: PostgreSQL 9.1, MySQL 5.5.31, MariaDB 5.5.31, Microsoft SQL Server 2008, Oracle Database 10.2. Following browsers are supported: Google Chrome 30.0, Mozilla Firefox 25.0, Apple Safari 6, Microsoft Internet Explorer 9 [6].

Web servers that are supported are primarily Apache and IIS. Although it is not fully tested (or supported) Moodle should work on current versions of Lighttpd, Nginx, Cherokee, Zeus and LiteSpeed [7].

Moodle's core features are: modern, easy to use interface, personalised dashboard, collaborative tools and activities, all-in-one calendar, convenient file management, simple and intuitive text editor, notifications, track progress. Administrative features of Moodle are: customizable site design and layout, secure authentication and mass enrolment: multilingual capability, bulk course creation and easy backup, manage user roles and permissions, supports open standards, high interoperability, simple plug-in management, regular security updates, detailed reporting and logs. Course development and management features of Moodle are: direct learning paths, encourage collaboration, embed external resources, multimedia integration, group management, marking workflow, peer and self assessment, integrated badges, outcomes and rubrics and security and privacy [3]. Moodle also have gamification and e-commerce features [4].

IV. MOODLE IN MEDICINE AND HEALTH CARE SETTINGS

There are more opportunities for the application of Moodle in health care. One of the frequent use of Moodle as a LMS is certainly in the education of medical students and students of nursing. The results of the learning outcomes from reference [8] show that well-planned distant learning combined with a properly selected educational measurement is an alternative for traditional methods of teaching. A range of empirically confirmed advantages presented in this paper and connected with such a didactic process may have a positive impact on the quality of teaching and ensure acquiring the necessary competences in the field of Evidence based medicine by the students of Nursing. Moreover, for the nursing education, it could be seen, that digital technologies have contributed significantly to nursing education, and that online forum tool proved to be an ancillary resource, although it needs to be used by professors as a space for interaction, not just listening [9].

According to the outcomes of research of Siria&Rui in their survey of a project for learning on-line courses in the fields of Sociology, Anthropology, and Epidemiology scheduled for students of Nursing, innovative approach offer a more responsible way to learn, which is self-managed, and course attendance also allowed students to share and discuss the educational material together. The survey results proved a very high level of student satisfaction [10].

In addition to applications for teaching nursery, Moodle can be applied in teaching surgery. In the study of Ureñ-a et al. WebCT and Moodle are used for the teaching of the core course "Basics of

Surgery". According to the outcomes of research, it is evident that a new types of communication established in the virtual classroom between the student and the lecturer allow an efficient flow of information that is very useful for learning, with greater participation and implication of the part-time lecturers that contributes to the efficacy of a computer based learning method [11]. For the purpose of hand surgery education Moodle could be also used. According to the outcomes of research of Rajarataran et al., it could be seen that, although there are some challenges that require competency and resources from subject matter experts, it is attainable to grow the utilization of an online educational program with a strategy of incorporating them into a blended learning environment [12].

For palliative care training in primary care, application of Moodle could be utilized efficiently. The results from the study of Pelayo et., al show that in addition to high satisfaction of palliative care professionals, there was a significant increase of knowledge and a significant increase in the perception of confidence in symptom management and communication in the intervention group in comparison with the control group that received traditional methods of education or no educational activity at all [13].

For the teaching and learning algorithms for acute patient care, Moodle could be also used.

In the study of Schwarz et al., it is presented an education portal (AKUTNE.CZ) that pretends to be a comprehensive source of information and education materials covering all aspects of acute medicine for students. Introduction of the new tools (Sandbox, WikiLectures, Moodle-MEFANET, and Serious Games) to their MEFANET network complement the portal platform suitably because they provide a higher level of interactivity for students during their self-study process. The Serious Games extension is designed for indexing metadata about simulation-based learning objects, also known as electronic virtual patients or virtual clinical cases. The feedback from the survey suggests that the students identify the interactive algorithms as an effective learning tool [14].

3D serious games with their strong interaction between them and the students are becoming very promising tool for education. In the study of Tubeloa et al., it is presented an implementation of interactive game in 3D Virtual City, adapted for the local-regional conditions which abandons the static form of distance learning platforms. It eliminates the need for travel and improves access to educational activities for primary healthcare professionals in different geographical locations. It is noted that the

feedbacks of the game can be considered new learning material for the students [15].

For depressive symptoms Moodle has the potential to serve as a useful mental health tool for educating people about depression, and be a source of social support. In the study of Lara et al., it is presented an

open-access, web-based, psycho-education, cognitive-behavioral intervention program (HDep) developed using the Moodle2 platform. Overall, the study findings Web-based interventions have an enormous potential to reach people with unmet needs. Results suggest that HDep is a promising mental health tool. Moreover, HDep feedback to users also stresses the importance of seeking professional help when depressive symptoms are detected, which could increase the diagnosis of untreated depression [16].

The University of Malaya has adopted Moodle as the main e-learning platform for all their courses. Integration of a Moodle e-learning site into the existing face-to-face teaching of physiology allowed more flexibility in teaching. According to the outcomes of research, the introduction of Moodle with its interactive features and online quizzes with instant feedback significantly improved student final physiology exam marks compared with the previous class that did not use it, suggesting that the implementation of Moodle as a complementary e-learning tool had a positive effect on student learning outcome [17].

V. DISCUSSION

Several years ago, we started to deal with systematic management of internal knowledge and then the learning management in our institution. For this purpose we created a knowledge management system which manages knowledge from documents generated inside the institutions. The system was upgraded and then we implemented Moodle as a complementary solution.

Our intention with this research was to examine how Moodle can be successfully applied in health care. This review presents information on benefits that Moodle can bring in to the educational work in health care organizations. The main reason for this research was to get a clear orientation and knowledge how to use Moodle in our institution in an optimal way.

VI. FINDINGS

After reviewing the current literature, we found 11 papers, which coincided with the objective of our research. These papers illustrate the successful implementation of Moodle in healthcare and point to the benefits achieved.

Perhaps the greatest benefit is the reduction of financial costs, but reduction in loss of time needed for travel and organization of the learning environment is also significant. It is clear that with increasing the interactivity, learning becomes more interesting, and knowledge is better accepted. We can clearly notice the successful implementation of the Moodle in the training of medical students, but it can also be applied in the training of professionals already working in health care in order to improve their skills, or adopt a new method. The paper shows that the Moodle can be applied in various fields of medicine ranging from psychiatry to surgery.

VII. CONCLUSION

Education and training of personnel has become very important in health care organizations today. In addition to the fact that knowledge which they held is directly related to the health and sometimes life of patients, personnel in health care organizations generate new knowledge. Maintaining the required level of knowledge and skills that are constantly changing and improving can become a daunting task. With the introduction of LMS this task can be facilitated. After reviewing the current literature, we concluded that Moodle can be successfully applied in health care organizations for education and training of healthcare professionals, as well as in medical Schools for students.

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Possibilities of Intelligent Search Techniques Applications in e-Government Services of the Republic of Serbia

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Abstract - In the process of developing e-Government in the Republic of Serbia, representatives of the MOI RS have developed and implemented a number of e-Government services to enable citizens and companies to simplify exercising right or obligations in the state authorities. Most of these services mostly concerning data records contained in the DBMS are intended for collection, storage and later use of data in charge of the MOI RS. However, specific e-Government services need additional scientific research activities related to intelligent search of large amounts of data. One such service is "Submission of Applications to the Police" intended for citizens, companies and government bodies to ensure transparency of police work. This paper presents a conceptual solution in terms of giving answers to the questions based on the existing knowledge base as well structured and unstructured data in the form of documents.

I. INTRODUCTION

This paper aims to present an innovative Web support - Intelligent Web Agent applicable in various fields of action of both individuals and businesses/organizations in today's information and global society, especially in e-Government as one of the most important fields for citizens, business entities and state and local governance. This issue has been researched by the Ministry of Education, Science and Technological Development of the Republic of Serbia within the project III44007 which subsequently led to the development of a prototype solution for Intelligent Web Agent intended for advanced information search [1]. This solution can be implemented in many e-Government services and in all services which provide such functionality.

The Strategy and Action Plan for the development of electronic government in the Republic of Serbia (RS) till 2013. [2] defines e-Government services to be developed and implemented by the Ministry of Interior (MoI) of the Republic of Serbia, with the aim to simplify exercising right or obligations of citizens in state authorities [3]. Some of these e-Government services

concerning the activities performed within the MoI need to be further developed and implemented like "Submission of Applications to the Police", intended for citizens, companies and government bodies to ensure transparency of police work. For further study, upon an EU call FP7-ICT-2013-10, the authors of this paper have recently presented a project idea and proposed, together with colleagues from the University of Paderborn in Germany, the form of conceptual cloud-kernel solution for giving answers to the questions on the basis of existing knowledge base as well as structured and unstructured data in the form of documents, as the core for the development of a wide variety of Web applications in various areas of sociological, economic and biological life of the human community and which allow automatic interaction with users [4].

Nowadays there are many applications of machine learning and data mining techniques in e-technologies government tasks and domains [5]: e-marketing, e-banking, e-learning, e-health, e-agriculture and etc.

Machine learning techniques may be used to analyze the data which is massive and complex, and their focus is on relevant information in large quantity of data. It was reported in previous research that for the purposes of collected data analysis may be employed machine learning techniques, such as decision trees, information theory [6], neural networks [7], support vector machines [8], genetic algorithms [9] and artificial immune systems [10] for choosing relevant features and elimination of irrelevant features in analyzed data. Machine learning can be used to learn user profiles and to detect anomalous behavior. Implemented agent in e-Government system may capture user profiles such as user IDs, login times, login areas, login frequency and login window size in log file. According to the

above literature, the following algorithm can be applied for detecting of personal and demographic behavior of users in e-government system.
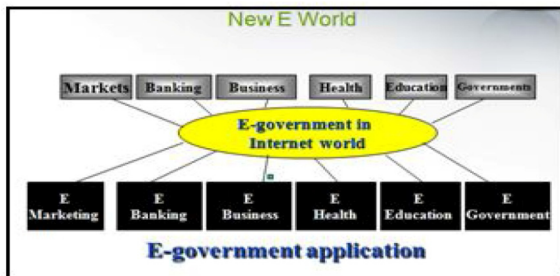

Figure 1. E -government applications

The most widely used text mining techniques [11] are discussed briefly below to enable better understanding of their application in the field of e-Government, citizen participation and e-democracy [12]. Question Answering (QA) application of text mining is answering of question answering, which deals with how to find the best answer to a given question. These applications can utilize more than one text mining techniques. QA is very important for implementation e-Government services where this service starts indexing search[13].

QA systems allow the users to ask questions in natural language, and retrieve the answers composed of unstructured text data. A successful QA system requires the use of advanced methods in both Machine Learning and Natural Language Processing domains, and it has significant application in e-Government services.

Muhlberger et. al, have implemented an Interactive Question Answering, Dialogue Analysis, and Summarization into a viable learning and discussion facilitation agent called the Discussion Facilitation Agent (DiFA) [14].They will try to keep citizens informed, on the fly, about changes and developments in the deliberation content, and summarize key arguments at the conclusion. QA are a type of Information Retrieval System, which process a question in natural language and return or extract an answer from structured or unstructured sources.

II. E-GOVERNMENT SERVICE "SUBMISSION OF APPLICATIONS TO THE POLICE"

Ministry of Interior of the Republic of Serbia along with the Academy of Criminalistics and Police Studies are currently in the process of comprehensive preparation to jointly develop a new e-Government service "Submission of Applications to the Police" within the newly established Center for the fight against cybercrime at the Academy of Criminalistics and Police Studies.

For the development and implementation of e-Government service "Submission of Applications to the Police", as well as other services for which it is responsible, the MOI RS requires complex scientific-research activity where the corresponding research related to intelligent search large amounts of data. This research could have a major effect on the level of the European Union (EU), and it is therefore only logical and appropriate that such a scientific-research activity is conducted through a cycle set HORIZON 2020 research and development within the EU, to support the different services in e-Government part of intelligent search.

A. An Architecture Framework Review

Proposed cloud-kernel core solution of the information system based on Web technologies is applicable in:

• Different e-Government services as information retrieval support;

• To supporting different systems for complaints and suggestions by using procedures based on the Web and applicable for managing and public services.

Such advanced e-Government and public services are intended to assist interested parties (citizens, businesses and public authorities) to make sound and timely decisions. Interaction between e-Government and the citizens/businesses requires the participation and collaboration of various institutions at the local, regional and national levels using dedicated applications. In addition to standard usage, it is also necessary to implement mechanisms for prevention, along with the solution scenario as one of the most important mechanism, in case those users do not get satisfactory reply, or do not get the reply at all.

Assuming responsibility and responding to these situations is the accountability of different state authorities (local-regional- national). There are situations when the information is exchanged with other state and international organizations using the direct communication and/or through joint international bodies. Since early computers, government and scientific organizations have been collecting the necessary data, analyzing them and trying to predict what could happen and how certain communities could be protected.

Today, there are a number of available technological options. Some of them are: internet and web that lead to the establishing efficient and low cost government information systems (e-Government), hardware technologies capable to keep/store terabytes of data (regardless their nature:

the original text, numbers, tables, images, code, etc.) and sharing data via fast and reliable communication channels, as well as complex calculations and analysis of collected data.

The purpose of this paper is to explain the motivation, objectives and overview of intelligent DSS based on Web technologies where the key algorithms will be used as a mechanism that helps in the decision making process in the described situations. Algorithms can be generally divided into two basic groups:

- The first group includes those in which previous decisions can be used for judgment based on known cases (for example, applications for suggestions and complaints of citizens).

- The second group consists of those made by using the conclusions of the famous group machine learning algorithms (such an application which offers the option to select one of the available options groups).

Common for both groups is the interactions between stakeholders and the automated system. The automated system is a system of connected and integrated institutions (joint institutions management is the best example) and such a system is based on questions made by stakeholders and the response delivered by the system. Questions and Answers accumulate over time into a kind of knowledge base. The answer coming from such a system represents a series of ranked documents.

B. Architecture design

The way of getting most suitable answer to the question is an essential issue concerning the scenario described above. The standard e-Government systems provide responses with the help of professional experts. To wait them to respond can take a few hours or several days. Moreover, these responses may not be complete and may force users to "knock at the doors of government agencies".

Internet is a place where DSS (shown in Figure 9) has a dominant position as a system in which questions are asked and the answers are obtained by using specialized applications. These applications integrate dedicated end-user tools to enable users to solve practical problems in the fields of sociology, biology and economics.

Both categories of the application can have three-layer architecture.

Suggested cloud-kernel solution as the core, after the development, will be implemented on the official e-Government Web portal of the Republic of Serbia

If your native language is not English, try to get a native English-speaking colleague, or somebody fluent in English to proofread your paper. Use grammar existent in text editor.

III. Deploying options of Agents based techniques in e-Government services

Bearing in mind that the spoken language of the population has the essential role in the aforementioned multiple domain Web service called Advanced Answering System (AAS), the solution will be tailored for the Serbian, Croatian and Bosnian-speaking countries, i.e. speaking countries of the Western Balkans and will include German and English as compulsory languages. In addition, this solution is good as a basis for the development of such systems in speaking area of the European Union using cross-lingual applications.

The basic application is bilingual. English is compulsory, but the second language is the language of the interested parties (beneficiaries). The application contains a maximum of three possible steps of cloud solution in which:

- The answer already exists in the existing knowledge base in a location where the question is made, or if it's not the case, anywhere else in the connected network cloud.

- The answer is created by specialized applications and technology (data storage, data preparation, data mining, DSS) at the location where the question is made, or if it's not the case, elsewhere in the connected network cloud.

There is no answer, so additional knowledge of experts should be used including data mash up and other technologies, such as 2D / 3D visualization.

It is important to note that the proposed solution will include two modes of data normalization.

A. Intelligent Web Searching Agents

World Wide Web is huge and unlimited source of information. One of the biggest advantages of the Web is a Content Diversity. Such quantity of content, by itself, could be a problem. Finding the correct specific information is often very difficult due to the complexity of the organization and the amount of information contained therein. The information is contained in the documents that have their names (Web sites) and are located in specific directories. Finding specific information requires knowledge of the exact address where it is located,

and to locate the necessary information, without adequate software tools, is almost impossible.

Fortunately, search systems like Google search, Alta Vista, Bing and Yahoo, and many others, make Web search easier. Internet search engines search the Web site; extract data, information and documents to meet the needs of users. Still, the results of these searches are not always relevant to the user's request, so intelligent agents have been developed to overcome this problem. Intelligent agents have such qualities and capabilities that are considered as new, highly advanced "shift" in IT. They are used all over the world, both in academic and business communities when making important business decisions.

Research of intelligent agents is a new scientific field. Research in this field can be divided into the development of the theory on agents, developing of agents architecture, and developing language-oriented agents, both those in which the agents are written and the ones used for communication between agents. Despite the difficulties, intelligent agents represent some kind of challenge because the arising benefits exceed the "problems" of their practical application

B. Agents

Generally, the term "agent" can be seen as an entity that carries out certain activities on behalf of someone. It is not easy to define the term "agent" because it is too abstract. The term can be defined in two ways: broadly and more specifically. However, all definitions of this term reflect different ways of understanding it.
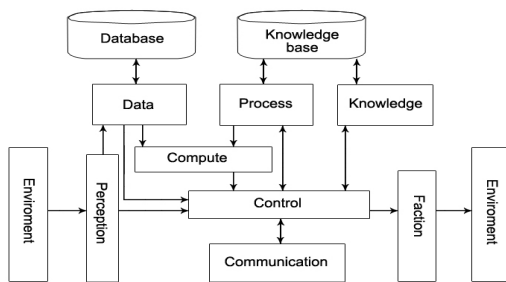
Figure 2. Agent architecture

When we say "agent" we usually think about an entity that independently operates in an environment, adapts to such environment, has the ability to perceive the environment, change the state of such environment, and has the ability to learn.

The term „agent "can be defined as:

Definition 1. The term agent is used to represent two orthogonal concepts:

- agent's ability for autonomous execution, i.e. regardless user's ability,

- agent's ability to make conclusions on its subject of interest.

Definition 2. An agent is something that can accept its environment through sensors and act upon that environment through effectors.

Definition 3. Autonomous agents are systems that accept complex dynamic environment, "feel" it and act autonomously in this environment and thus realize a set of objectives for which they were designed.

Definition 4. Agents are permanent programming entities intended for a particular purpose. This means that agents differ from sub-programs; Agents have their own ideas on the execution of the task, posses own schedule. This specific purpose makes agents different from fully multifunctional applications; Agents are smaller.

Agents can be divided according to several criteria. Operations of an agent can be reviewed within its given environment. The state of the environment is changed along with its interaction with such environment. Generally, agents can be divided into "weak" and "strong".

The term "strong" is most common in the field of artificial intelligence, and the agent has the following characteristics:

- Mobile: Agent can move from one network node to another. Each mobile agent consists of three components: (1) the program code that contains the agent's logic, (2) data, i.e. internal attributes that represent the knowledge that the agent possesses, and (3) the state of execution.

- Rationality: If the agent has a set of objectives, of which only one is active, it will not perform actions that might be in conflict with its current goals. A rational agent must always perform actions that would maximize the expected result, thereby using own knowledge of the current and future state of the environment.

- Benevolence: Agent's targets may not be in mutual conflict if an agent is expected to maximize the expected result.

IV.   USER DATA COLLECTED BY AGENTS

Intelligent agents can be very useful in

accomplishing the so-called e-surveillance. Electronic surveillance or e-surveillance can be defined as system investigation or motion monitoring / communication of one or more persons on the Internet, aiming to gather information on them, their activities and inter-connection. Independently, intelligent agents on the Internet (1) could conduct (2) search activities (3) very successfully on behalf of and for the needs of various users. Due to the efficient gathering, manipulating and management of the data, this software could be of great interest from the intelligent data analysis point of view in various fields of the police forces activities. Police analysis of data gathered by intelligent agents (software robot - bot) could be successfully exploited [15] in the field of the QA. It is necessary to take a closer look into the existing techniques of artificial intelligence used for making a conclusion in intelligent agents in order to effectively utilized gathering and analysis of data from criminal activities.

Automated data collection on the Internet is nothing new, and scrapers continually access and repost data for other websites. This information is often highly valuable to the businesses that collect it, and they go to great lengths to protect it. Search engines, PageRank2 and advertising all use bots to collect information stored by others. Web services can gather information from data hosts—websites that store or house target data—primarily by parsing or scraping data. Parsing generally refers to the collection of information from the data host directly3. Parsing accesses a website's underlying data structures through a series of formalized data requests, often through application programming interfaces ("APIs"). Computer vision APIs such as Diffbot must turn the web contents into your database. The article API4 is used to extract clean article text and related data from news articles and blog posts. Retrieve complete text, normalized HTML, related images and videos, author, date, tags-all automatically, from any article on any site.

V. CONCLUSION

The prototype of the proposed advanced AAS as three-layer cloud solution enables rapid responses to interested parties and provides high quality automated machine which gives answers. It also represents the core which enables developing various tools in cloud environment in all fields of work in the community.

The application of such sophisticated e-Government service " such as "Submission of

Applications to the Police", and future " Eligibility criteria for participants on jobs" which can be included in future strategy - formulation activities of the Ministry of Interior, provides a high degree of automation, timely and complete responses for citizens and businesses, and accomplishing tasks in more qualitative and efficient way for civil servants.

On the Internet, an intelligent agent (or simply an agent) might be successfully exploited in the field of the QA systems. Web browser intelligent - methods of artificial intelligence should be used in finding data in intelligent data analysis - data mining widely applied in the fields of business administration, economy, mechanics, medicine, genetics, traffic, etc.

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Module Single Use of the Information System 'Treasury'

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Abstract - The term denotes social information system based on the ability of information technology which includes not only the hardware, software and content or data, but also the organization, initiatives, procedures and people who are all involved in it.

The information system of local government was implemented as an integrated system of software modules covering the entire business of local government. Budget business module is the most complex set of financial operations of a local government.

I.   INTRODUCTION

The information system is any system developed for the purpose of creating, collecting, storing, transmission, processing and interpretation of information.
Application software for budget accounting is a unique program tailored in accordance with the latest laws and above all the Law on Budget System.

The municipal administration Kovačica in the Department of Finance, Budget and local tax administration is using the package of financial modules and Fixed Assets, Financial accounting - liquidation and Payroll.

The objectives of the work are clearly and precisely defined, and it is to point to improved interaction between the user and software so that computers will make it easier and more convenient to use in their work.

II.   DESCRIPTION OF WORK MODULE

The municipality is the basic territorial unit in which local authority is exercised and funded from the original and shared revenues, as defined in the LS as well as from additional funds.

The municipal administration Kovačica in the Department of Finance, Budget and local tax administration is using the package of financial modules and calculation, Earnings, Financial accounting - Fixed assets and liquidation.

Payroll is a software package that provides payroll employees in accordance with legal regulations.

Each user can customize the application to their way of calculation in Financial accounting - liquidation provides updates and monitoring of financial operations, reports for internal use, official reports and records in relationships with customers and   suppliers.
It allows the automatic download of information from other parts of the system.

It provides fixed assets and records of fixed assets and the corresponding changes in them, budget as well as the calculation of depreciation, revaluation, and various press review.

For the successful use of business modules when necessary, IT systems are intended to the management module of the following structure :

TABLE 1 - OUTLINE OF OPERATION OF THE MODULE

Naziv radnog mesta	Br. izvršioca
rukovodilac odeljenja	1
šef službe	1
samostalni stručni saradnik za EOP	1
radnik za knjiženje, obračun i kontrolu	3
UKUPNO	**6**

Especially important role in the realization of the module needs to have continuous activity of education personnel, automation of their work and adequate forms of functional organization. Personnel training is one of the key preconditions for the realization of the module. The current levels of knowledge of the staff and continuous development of information technology require permanent innovation of knowledge.

The training program for the operation of the module is:

- completed basic course in MS Office,
- seven- day training for application and use of software applications.

On the web at www.zup.co.rs (Institute for advanced operations), one can download a new version of the program -Program Budget Accounting Treasury.
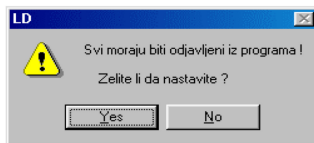
Figure 1.

Select a row from the options to download versions - Financial, Payroll and Fixed Assets.

Download using the access ID and password that is assigned to you.

Choose the folder whrere you download a new version and where you want to save the file that was downloaded from the site.

Figure 2.

The installation of the new version requires a program named Total Commander. It is necessary to create a folder called Archive and the other side of the operating display requires directory UK Treasury. Create a folder with the date for the preservation of the file. Choose the folder where you stored that. Save the new software version and unpack the file.

Choose firme.exe, start date, and type a password. Then select the new version and complete the check of data structures. Check offered empty space, type of company code and confirm.

Figure 3.

Figure 4.

To properly complete the necessary procedures, all users of the program have to be logged in. It is important that at the end we find a message on the screen "Placement of a new version has been completed."
Always exit from all programs at the end of the icon. Otherwise, the database will remain opened and the program will not work i.e. will report an error.

Figure 5.

It is necessary to record the data and run the application software in the following steps:

Uputstvo za snimanje podataka

Unesite svoju šifru
Unesite svoju lozink
Izaberite firmu
Slika1.

Pritisnite opciju
snimanje/vraćanje
podataka
Slika2.

Pritisnite <YES>
Slika3.

Figure 6.
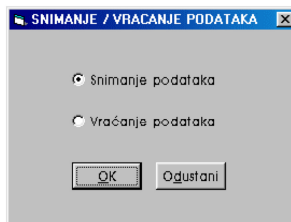
Pritisnite <OK>
Slika4.
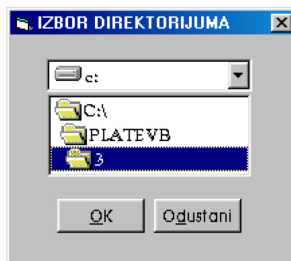
Pritisnite<OK>
Slika5.
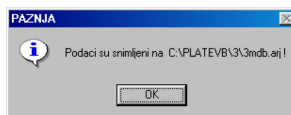
Pritisnite<OK>
Slika6.

Slika 6 pokazuje gde su vam podaci sacuvani, iste mozete iskopirati i narezati na cd i posebno sacuvati.

Figure 7.

III. ADVANTAGES

The design of the interface is such that the user can use it in an easy way, and have fast data entry.

When you enter there are logical controls in order to reduce the possibility of error.

User is always available of additional functions such as calculator, help for the current option, calendar, etc...

The modules are unified such as menus, so one can use the function keys, the options for printing, importing, editing, and so on.

Benefits of financial modules are following :
- ease of entry and time data,
- availability to the ledger,
- quick calculation,
- large number of reports that are automatically populated with data,
- automatic formation of text files for electronic payment,
- review and approval of payments received and obligations,
- certificates of deposit / withdrawal,
- the possibility of keeping the basic resources for multiple users,
- the existence of the completed code list of groups and subgroups according to the official nomenclature.

IV. RESULTS

The modules are linked into a single software system so that there is no redundancy in the input data, which means that once entered, information is visible and accessible to all the modules.

It enables automatic generation of data in the individual modules on the basis of previously entered data in other modules.

The program is designed for multi-user operation and simultaneous access to data by multiple users. At the user level there are three levels of protection developed:
- the first level is to define access rights to the modules,
- the second level is to define the right to run certain items on the menus,
- the third level is the rights of access to certain databases.

Common benefits of financial modules are:

- quick and easy data entry,

- transparency of the data entered,

- uniqueness of the required codebook,

- the availability of users for changes / additions,

- taking statements and electronic payment,

- the possibility of determining the level of use within the module,

- creation and printing of various reports.

V. CONCLUSION

Modern of the local government requires constant monitoring of all developments in society especially in terms of information technology.

The aim of modern local government functioning is sustainable in character because the local government is financed from the budget and it undertakes that after the implementation of all the new obligations of local goverrnments performing faster and better.

The rapid and timely exchange of information among municipal departments and other agencies as well as public and municipal enterprises, compared to the previous mode was enhanced and increased in efficiency of employees.

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Prevention as a Method Against Digital Violence

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Abstract – **This work deals with one segment of digital world that is rapidly developing. Along with powerful development of IT, there are new trends evolving parallelly bringing with themselves a surrounding with undefined rules or difficult control. Media literacy becomes a necessity, and introduction of Informational and media literacy becomes part of school curriculum. The possibilities to access information have never been so great. It has become possible to have a teaching process with a teacher and a student thousands of kilometres apart. Unfortunately, it has been recorded that there is increase in misuse of digital space and that the problem of children's safety on the internet has to be seriously approached.**

I. INTRODUCTION

A. Information and communications technology

Information and communications technology (ICT) in 21st century have undoubtedly essential place in all spheres of life, including education. Thus, teachers have to change considerably their approach towards teaching process and involved students, especially bearing in mind that the latter ones are members of digital generation. Prensky (Prensky, 2001: 1) says that generation has spent their whole life „surrounded by computers, video games, cd players, camcorders, mobile phones and all other toys and tools of modern age,"2 and thus they think and process information in a completely different way than earlier generations. This gap between the generation of digital natives (the young) and digital immigrants (the old ones) is reflected in the area of education, causing the problem which Prensky (Prensky, 2001: 1) describes saying that the teachers are digital immigrants using the outdated language in digital age struggling to hand to generations which use completely different language. Implementing information technology into pedagogical and educational work is a professional necessity of a contemporary teacher. It can be seen through required continuous professional development and professional communication between colleagues, parents and children, but it also implies technological competences. Technological competences of a teacher can be described through ECDL standard (European Computer Driving Licence), then professional need for enriching pedagogic culture of parents in technological surroundings, and immediate work with children. Apart from the example of implementation of information technology as aimed activity, this work presents a segment from the survey on teachers' willingness to use information technology within their pedagogical practice and professional development.

B. Educator

A professor, teacher or educator represents an important aspect in every educational approach. In modern terminology the word professor is very often replaced by the word educator. Since ancient times, intelligence, wisdom and personal characteristics of an educator have been respected. It is especially seen in the works: Socratic Dialogues (Σωκρατικὸς λόγος,) by Sokrates (Σωκράτης, 470/469 – 399 BC) and Plato (Πλάτων 428/427 or 424/423 - 348/347 BC), Paedagogus (Παιδαγωγός,) by Clement of Alexandria (Κλήμης ὁ Ἀλεξανδρεύς, 150 - 215) and Ars rhetorica by Marcus Fabius Quintilianus (35 - 100). The characteristics of an integral persona, respected in ancient time, have, as time passed, gradually faded and the focus has been moved to expert competence.

II. MEDIA LITERACY

A. Basics of Media Literacy

There are numerous definitions of the notion 'media literacy', but all of them are more or less reduced to–the ability of comprehension, critical and analytical acquisition of media contents, as well as to the knowledge and skill of creating media messages in accordance with professional and ethical standards in education system. Modern world, as well as its surroundings, are complex phenomena which are impossible to be percieved and understood via direct experience. All of our knowledge is more or less mediated, and the most frequent mediators are mass media in the broadest terms (newspapers, TV, radio, internet portals, social networks...). As much as

some people think that they do not affect their lives and decisions, just think for a moment on what grounds they have made their opinion about people they have never met or events they have never taken part in.

Mass media and their contents should not be ignored or taken for granted, because it is not possible, after all. One should critically observe them, get familiar with their rules, recognize their enormous capacity both in educational and social field/, but also its manipulative segment which proportionally develops alongside the rise of media misuse. Contemporary culture is saturated with the amount of information. We are constantly bombed by them, from all sides. Very often, as a reaction to that bombing we unconsciously process those messages and leave space for media and its content to shape our thoughts, even if we do not see that. Namely, today we have a problem of how an individual to manage in the ocean of information and protect from their abundance, to recognize the true, complete and objective information. For that, visual feeling is not enough. It requires certain level of knowledge and competence, and that knowledge and competence is not something we acquire once and forever, but a process that lasts for the whole life.

Media literacy is also a response to technological advance that has led to the change of the very essence of media. On one side, there is inexhaustible source of information and on the other the need for increased media concentration, especially on the internet. Usually, we are under the impression that we have everything under our control and that we are those who make decisions on the internet or in media, but unfortunatelly, the reality can be diametrically opposed.

Finally, media literacy is not only a skill by which a man manages rationally, expertly among huge amount of information and recognizes the right and complete one. Media content possess several aspects. They can provoke hatred, anger, happiness, disappointment in people. They can affect our visual judgement by various aesthetic interventions and we value them morally according to our consciousness. Media literacy enables not only critical acceptance of media content but also to work on our own improvement and acquaintance.

Also, we have to bear in mind that we ourselves are also creators of media content. Our statuses, sharing, twits, blogs...[3]

III. PREVENTION OF DIGITAL VIOLENCE

A. Basics of prevention

Prevention of digital violence should be carried out on all levels, starting from the individual, family, educational institution, state institutions, society in general [1].

When educational system is in question, both preventive and emergency activities related to violence, abuse and negligence are regulated by law rules, i.e. legal documents. In many countries in the world, media literacy is implemented into curriculum of all school subjects, on all educational levels. The key role in prevention of digital violence play two key terms, digital literacy and social skills.

Digital literacy

Developing of digital literacy with the young and old is aimed at improving their competence of applying technical measures for protection, but, more importantly, at making them aware of risks, as well as of potential and positive aspects of using digital technology.

Social skills

Acquiring social skills, i.e. competence for non-violent communication in real and digital surroundings, as well as nurturing domestic/scholastic atmosphere which does not tolerate any kind of violence, let alone digital.

B. Developing awareness for significance of prevention

As in every cultural society, certain rules of behavior should be followed in digital world too. Good manners should be the part of every segment of our life. That's the way we should treat others, with respect, whether we communicate by email, chat, social network. Well-mannered and civilised.

It is important to be aware of traces we leave in digital world. Every twit, post, share leaves digital mark which may be active or passive.

It is necessary to take special care to the use of vocabulary. Unsuitable, harsh or vulgar messages can hurt someone, even accidentally.

One should be careful when sharing personal information, especially those which are not ours. Official INSTRUCTIONS FOR DATA PROTECTION and RULES FOR CREATING SECURE PASSWORD are in force.

Means of technical protection are necessary to prevent possible violence.

Help the one who is not familiar enough with the internet. That is how we make the internet be more secure place.

Awareness of digital violence is very important because the young are often unaware of the fact that they are suffering or producing violence with their behavior [4].

C. Safety Control

Showing interest for what the student is doing on the internet is crucial as well as talking about advantages of using digital technology and multimedia content which contribute learning and broadening the knowledge. Continuous improvement of one's digital competences, being up to date with the latest means of protection from digital violence makes protection better.

Asking assistance from children related to new technologies is not a weakness. On the contrary, it is a sign of strength. In that way, we show appreciation to the student and strengthen our relationship based on mutual trust. By our own example we give a model for student to ask and seek support. We encourage a child to cope with the pressure from peers constructively, not being ashamed to say NO [2].

Potential risks on the internet are everywhere, thus it is crucial to listen to what students have to say about sources of danger. Also, it is necessary to define together the rules on using the social networks, as well as consequences in case of their violation. Participation in establishing the rules increases the probability for their compliance. It is almost impossible to ban the use of social networks, and intimidation and threats do not give good results and do not contribute to abetment of child's development. For child's upbringing the quality of established relationship is crucial. It is very fragile and easily lost, so it is essential to thank a child when sharing the internet content with us. Fear and anger should be controlled because in presence of these emotions it is difficult to propose any constructive solution. You are obliged to take responsibility for your own acts and to behave in accordance with the rules you propagate to your students.

IV. CONCLUSION

In today's world, there is no formula for absolute safety. Prevention, in any form, is a way to increase the safety in digital world. Prevention of digital violence is a complex process and it has to keep up with information and sociological innovations. The concept of diversion of awareness with children offered by pop culture is particularly interesting. Namely, the MTV programs showing abuse of social networks are very popular, with direct participation of deceivers and the deceived, reality prevention, why not.

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Information System as a Tool in the Development of a Quality Analysis System

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Abstract - In this paper we presented the information system of the College of Applied Technical Sciences and Technology in Kruševac, named ATEIS (Advanced Tertiary Education Information System), which has been developed at the College of Chemical Technology in Kruševac. The system encompasses Student Service Application, Students Application, Professors Application, as well as Quality Assurance Application. The ATEIS information system was developed on a multilingual platform based on the PHP and Ajax languages. For the purposes of data storage and archiving it uses the MySQL database. The PHP platform provides a secure access to the aforementioned database directly from the server, while the Ajax and JavaScript make the user interface user-friendly. After a brief description of the aforementioned panels, as well as the technology and methods of statistical data processing, the development of the Quality Assurance Application was presented as an element of an integral information system. The ATEIS monitors the most significant static and dynamic characteristics of the College which enables the use of available resources, as well as upgrading and specializing in the development of quality systems.

I. INTRODUCTION

Integration processes in the European Union are very important, especially in the sphere of education. National economies become increasingly connected and interdependent.

Deepening of economical, scientific and technological relations among various countries is a result of the development of productive forces which show a high concentration of knowledge and capital that require a more powerful scientific base, huge markets and a large amount of energy and resources. In recent years, quality assurance has become a global process through education internationalization. The application of international standards, quality control and improvement has become the imperative of modern education.

The important steps in approaching European standards of education lie in common frameworks in the fields of quality assurance, student service, IT service and international office. Quite aware of the fact that nowadays it is necessary to comparatively and interdependently develop the systems of quality assurance and information technologies, the

development team of the IT service of College of Applied Technical Sciences and Technology approached the development of a unique information system. The entire process of quality system management has been described in the files of the Quality Assurance Service of the education facility, and the topic of this paper is the implementation of the aforementioned process through information technology support by means of implementation of applicable solutions.

II. INFORMATION SYSTEM OF THE TERTIARY EDUCATION

The Tertiary Education in Serbia is committed to realizing the Bologna Process as successfully as possible. Bearing in mind the significance of quality from the standpoint of keeping up-to-date with modern trends, the consortium of the College adopted the common quality assurance policy. The goals of quality improvement within the College comprise the following:

- providing an active support for every participant in the process of education (teaching and non-teaching staff, as well as students) in their effort to improve their own quality;

- emphasizing the importance of education quality improvement and defining measurable indicators of quality criteria;

- introducing a system for the assessment, monitoring and improvement of every participant;

- improving the quality of inclusion of every participant

The Quality Assurance Service submits semi-annual reports regarding the outcomes and evaluations representing the extent to which the College functions according to the principles of the established efficacy. All services take care of the specific needs of every department, study program, semester, course and staff member. The

Commission report is represented to the public in all available forms. The information system follows the most significant static and dynamic characteristics of the College, which enables the use, specialisation and upgrade of all available resources in the process of system development. Through static and dynamic characteristics of the College one shows the usability, functionality, performances, as well as the economic and technological limitations.

The most significant characteristic of the information system is a support for the quality of the teaching process and the ability to adapt to quick changes, not only in the immediate (national), but also in the global environment.

The role of the information system in monitoring the quality of teaching process in schools is of the utmost importance. The system of quality as a basis of a regulated education system represents the necessary condition for the development of a decent information system. The issues of defining clearly delimited responsibilities within the College of Applied Technical Sciences and Technology, as well as quality assurance policy, and relying on globally recognized standards are some of the issues which represent the basis of the information system.

A. Technical features of the information system

During the development of the ATEIS main tasks were:

- storage and organization of large-scale data
- data security and information confidentiality
- access to data
- different levels of access to data
- automated data processing
- different types of users

Based on these requirements relational database and Web technology were selected provided by its access and update. In this way, the data that is mutually correlated is optimally connected, and access and update could be provided from different locations and with more clients simultaneously. For the realization MySql database and web programming language PHP and JavaScript were used. ATEIS has multiple levels of data access, depending on the class of users. Classes of users are:

- Student Service
- Lecturers (professors and assistants)
- Quality Assurance
- Students
- The Ministry of Education

The functions of each class of users and processing capabilities of the data are clearly defined and limited.

Because of the potential web access to the system, special attention was paid to data security. On ATEIS all existing protection systems ranging from server of certification, encryption, user names and codes over other solutions in the implementation were used.

The database contains more collection of data organized into different classes or interconnected. In addition to the basic master data recorded on students and their activities:

- pre-exam activities
- logged exams and exam results
- payment
- transfer of ESBP points
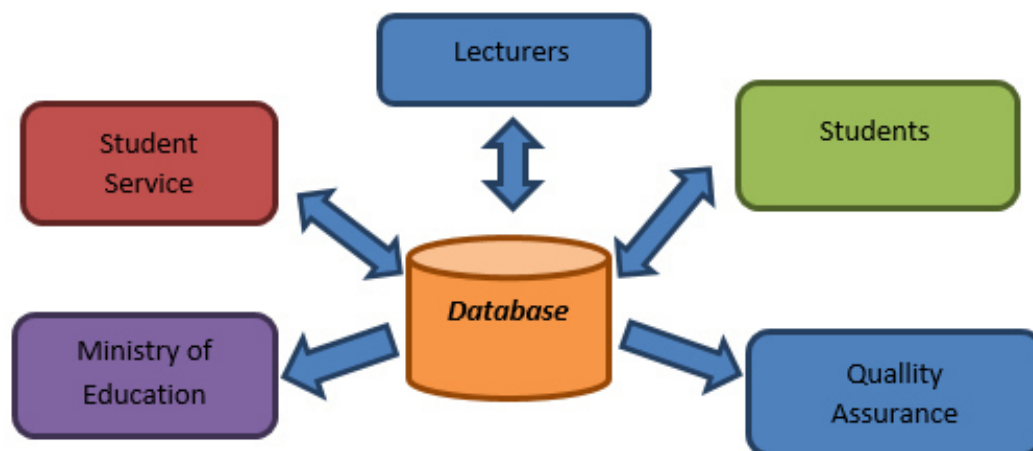
Figure 1. Organization structure of ATEIS informational system

• assessment of teaching staff and services by students

The ATEIS database represents a valuable source of information for analysis and prediction. But most of all for the advancement of education of students.

B. Data analysis

Data stored in the database are subject of further analysis and processing. Different tasks can be applied, such as the following general tasks from the domain of low-level user activities:

• value retrieval – finding of specific attribute values for data cases (e.g. find when the student passed the given exam and with what grade),

• filtering – finding data cases which satisfy the given conditions in relation to their attributes (e.g. find the students that have qualified to do the final exam),

• compute derived value – finding the appropriate aggregate numerical value for data cases (e.g. find the average grade for the given course in the given time),

• find extremum – finding data cases with extreme attribute values (e.g. find the student with highest average grade in a school year),

• determine range – finding the range of attribute values of interest for data cases (e.g. find the span of the results of pre-exam activities for a given course),

• characterize distribution – finding the distribution of the quantitative attribute of interest for data cases (e.g. find the distribution of the grades for a given course at a given time),

• find anomalies – identification of any anomalies with respect to a given relation or expectation, i.e. statistical outliers (e.g. find the students that did not attend any lecture for a given course),

• clustering – finding clusters of similar attribute values for data cases (e.g. divide the students into two groups according to their previous grades in order to give lectures at two different levels),

• correlation – finding useful relations between values of two given attributes for data cases (e.g. find the correlation between the pre-exam and the exam results).

As can be seen, the suggested starting framework for the data analysis offers a very broad spectrum of useful applications which should certainly contribute to the quality of schools' functioning. Also, it is easy to imagine a specific analysis which can be included into the information system as one of the indicators of the quality of professors' work. For example, if one professor has correlated bad indicators for multiple courses (e.g. low attendance), that should probably represent a certain sign. Of course, it is possible to imagine a different scenario, where, for example, survey results from the students that did not attend the lectures would not have been taken into the consideration.

Advanced techniques of data analysis can be relatively easily embedded into the existing general framework of the information system, if there is a specific demand. Various techniques from the domain of artificial intelligence aimed at expert systems are available, such as pattern recognition, neural networks, fuzzy logic etc. It should be emphasized that the development of these techniques can represent an academic activity per se, which can include professors and students and contribute to their mobility and to the cooperation between different institutions.

C. Surveying and gathering the data relevant for the Quality Assurance Service

The ATEIS is intended for supervision, communication, archiving and student data administration during three-year vocational studies, which immensely facilitates the process of gathering relevant data connected with quality and statistical analysis. It should be emphasized that the entire system is automated (it is automatically determined which courses students attend within a particular study program, which exams they have the right to apply for and take, how many ECTS points they have the right to transfer, what the status of a student is, conditions, etc.), as well as that data gathering is done on all users in one data base. On request, relevant data are distributed in either original or processed form for the purposes of a specific student service. This facilitates the work immensely and increases the efficiency and productivity of the Student Service. Personal data entered in the register are collected, processed, kept and used for the purposes of educational policy in accordance with the Law on Personal Data Protection.

The functions and possibilities of the system are manifold. In the paper we will present only those functions the purpose of which is to gather data significant for ensuring and improving the system of quality.

The functions of the Student Service are: the possibility of communicating with students and employees via notifications (this function

significantly saves paper consumption regarding printed notifications…); monitoring and recording student files (Register Book and ŠV-20 form); keeping records of the language of study programs, mandatory and optional courses, foreign languages, data on pre-exam activities, data on the exams taken, pre-exam evaluation marks, earned ECTS points, data on awards and commendations received during the study period, as well as on issued public documents.

The basic functions of the application intended for the students encompass the transfer of all administration activities which students usually perform over the Student Service window to the Internet environment. As a result, the load of student administration is reduced and administrative procedures are accelerated. Likewise, easy categorization and data processing leave little room for errors, which can occur at the peak of exam and entrance terms, thus influencing favorably an increase in the quality and professionalism of the institution. In the student survey panel students can anonymously fill in the questionnaires sent by the Quality Assurance Service. Filling the questionnaires is fairly simple and does not require a lot of student´s time. In case that a student does not fill in the questionnaire all his/her activities in the panel are blocked until they finish the process. The data obtained through the survey are anonymous and in accordance with the Law on Personal Data Protection the purpose of which is the anonymity of

students and the exclusion of the possibility of unintended consequences. A systematic examination of students on the quality of work of the teaching staff is realized by the Quality Assurance Service. The evaluation is done through the specific questionnaire for the evaluation of the teaching staff. The goal of this examination is offering feedback information to the teaching staff on their quality of work in the teaching process and while working with students. By means of communication with students and their representatives the teaching staff are obliged to offer a review of the conducted survey and together with students analyse the fields in which changes are necessary. If some teachers do not change for the better in spite of the negative feedback, it becomes a very important criterion in the process of their reappointment. In the current phase of education development, a success can be secured by a more intensive orientation to people. This issue concerns the deciding competitive advantage which can be secured with highly competent and capable employees who are ready to achieve a certain level of performance. Every change in education is a learning process for many individuals, and quite often even for every single employee. The changes can be conducted without frustrations and dissatisfaction only if every person concerned is included in a timely fashion and if they are certain that they can give their contribution. In order to achieve the planned behavioral change everyone needs to be clear about the traditional,

Figure 2. Part of the student questioner panel

current norms of behavior, and then compare them with the desired ones, i.e. with the norms of behavior of the future. If changes in education imply certain changes in one´s behavior, we inevitably enter the cultural domain of the College. Changes in behavior always cause the changes in attitude, which can be achieved only when one is certain about the necessity of such a change and the validity of the new norms of behavior.

The menu consists of four groups of links for the evaluation of the survey items connected with general questions, study, course and teacher evaluation. By clicking on the link within the menu in the central part of the page one opens the content regarding the chosen link. The group of links for general questions, study evaluation and service evaluation is common for all students of all the departments of the Tertiary Education facility and for all study programs. The links within the group for course and teacher evaluation contain the list of courses which a student attends in the current semester or school year, depending on whether the survey is conducted for one of for both semesters. The students of a specific year and study program are offered a list of all courses for the given year of study and study program. The initial content in the central part of the page represents a short instruction for students on the manner of completing the questionnaire and the goals of electronic survey.

D. *Quality evaluation and presentation of the analyses statistical data*

Quality evaluation is a systematic and elaborate process. The reasons lie in the fact that each one of us attaches special importance and value to the way

we perform at work, especially if we are convinced that we always give our best. The evaluation of the teaching staff quality is done on the basis of the criteria assigned by the Tertiary Education facility. Commitment to work, enthusiasm, attitude, willingness to cooperate, responsibility, motivation, discipline and ambition are characteristics deeply ingrained in our personality and can be changed very slowly and only through significant difficulties. When the results of the survey are joined with specific desired levels of success, the mark of quality is no longer subjective. Each individual knows what he/she is expected to do. What is more, every individual can plan his/her own quality. The kind of control secured in this fashion is objective and ensures improvement.

Application panel intended for the Quality Assurance Service comprises the following:

- The possibility of sending notification to the staff (according to the study programs, modules or individually)

- Monitoring of all data necessary for the Quality Assurance Service which are in accordance with the Law on Personal Data Protection

- Creating and sending questionnaires to students (in case that students do not fill in the questionnaires their student panels are disabled, as well as their activities in student administration, until they fill in the questionnaire)

- Overview off the results of the survey and statistical processing of all data which are of any interest for the improvement of the

Figure 3. Exported results of student survey

quality of higher education institution

- Graphic display of the results of the survey.

III. CONCLUSION

By using the presented information system the management of the Tertiary Education facility and the Quality Service are enabled to exercise continuous and systematic control over the realisation of accepted standards and to conduct corrective measures if there should be any kind of deviation. The information system focuses on the opinion of students as the highest level of quality system abstraction. Owing to its modern structure the architecture of the information system can precisely adjust to the requests of the system of quality, and owing to its openness it can be combined with the applications defined earlier. The designed information system offers quick and efficient introduction and flexibility in future changes.

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Software for Hazard Scenarios Modelling

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Abstract – Increasing frequency of potential hazards realization over the globe, in the past few decades, led up to the demand for experts in disaster risk management field. Thus, study program Disaster Risk Management and Fire Safety Engineering has been accredited at the Faculty of Technical Sciences in Novi Sad in 2011 year. The main goal of the study programme is to provide profile of experts capable to comprehend and manage hazardous phenomena. Accordingly, hazard scenario modelling is the main task at the 3rd year of the study program within the subject Modelling and Simulation in Risk Management. During practical exercises at the subject, students are educated and trained for the use of different software applications for hazard scenarios modelling, simulation and visualisation. In the computer laboratory students become familiar with ALOHA, Quantum GIS, SketchUp and Pathfinder software applications. This paper provides an overview of the methods and potentials for use of each listed software application for the purpose of hazard analysis.

I. INTRODUCTION

Increased number of hazardous events realization, in the past decades, accelerated development of disaster risk management field and, as a side effect, caused demand for educated and experienced experts in the field. Therefore, at the Faculty of Technical Sciences in Novi Sad, study program "Disaster Risk Management and Fire Safety Engineering" (DRM&FSE) have been created in 2011 year. Attending and prospective students of the study program have an opportunity to learn about fundamental and applied disaster risk management concepts. The mission of the study program is to create engineers competent for the analysis and management of the real hazardous situations. In order to achieve this, at the 3rd year of the study program, within the subject "Modelling and Simulation in Risk Management" students are encouraged to analyse various hazardous scenarios by creating models of real system and processes within it. For the purpose of modelling different software applications are used during practical exercises at the subject. Following is an overview of possibilities for hazard scenarios modelling, simulation and visualisation by use of ALOHA, Quantum GIS, SketchUp and Pathfinder software packages.

II. ALOHA

ALOHA (Areal Locations of Hazardous Atmospheres) is a computer program designed to model chemical releases [1]. Its primary purpose is to provide emergency response personnel estimates of the spatial extent of some common hazards associated with chemical spills. It deals specifically with human health hazards associated with inhalation of toxic chemical vapours, thermal radiation from chemical fires, and the effects of the pressure wave from vapour-cloud explosions. [2]

ALOHA uses a graphical interface for data entry and display of results [2]. The user is required to provide input data about location, identity of the chemical, local atmospheric conditions, and details about the spill scenario. Data entered in the hazard scenario model as well as results of the calculations (e.g. release duration, amount released, release rate) are organized within text summary. Another output from the model is graphically represented threat zones.

Threat zones represent the area within which the ground-level exposure exceeds the user-specified level of concern at some time after the beginning of a release [2]. ALOHA will display up to three threat zones overlaid on a single picture (Fig.1). Threat zones can also be shown in Google Earth (Fig. 2) or Google Maps using ALOHA's KML export feature. [1]
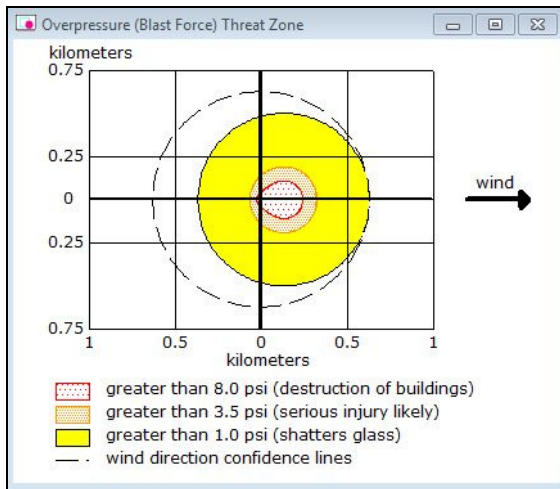
Figure 1.   Threat zones graph

Figure 2.   Threat zones vector displayed on Google Earth

Identified threat zones of human and infrastructure exposure to the hazard, owing to spatial dimension and form of the ALOHA output file, could be input for further hazard analysis. Threat zones vector could be visualized and set in the spatial context with a given hazard environment by use of GIS software.

III.   QUANTUM GIS

GIS (Geographic Information System) is valuable tool for the input, storage, integration, analysis and cartographic visualisation of geographic information [3]. A common feature of GIS is that you are allowed to associate information (non-geographical data) with places (geographical data) [4]. Since, hazard phenomena realization is related to certain spatial extent, GIS has been widely used in the process of disaster risk assessment.

For the purpose of students' education within the subject Modelling and Simulation in Risk Management, Quantum GIS (QGIS) were used. QGIS is an open source GIS that allows users to create maps with many layers using different map projections. Maps can be composed of raster or vector layers. Vector data is used to represent points, lines and areas. Raster data is used when it is

necessary to display information that is continuous across an area and cannot easily be divided into vector features [4]. Either raster or vector data could be associated with non-spatial attributes.

Students' task was to convert threat zones diagram created by ALOHA into vector layer and to load it into Quantum GIS project jointly with OpenStreetMap raster layer (Fig. 3). Then, each student had to individually observe spatial relations within and beyond identified hazard zone. As a result of observations and further research students had to acquire data about exposed and particularly vulnerable population and infrastructure within hazard zone, as well as data about elements that could increase resilience of the targeted community. Finally, data provided had to be implemented into Quantum GIS project in the form of vector layers representing observed elements at risk.

IV.   SKETCHUP

Examples of elements at risk are people, buildings, agriculture fields, economic activities, industrial complexes, roads and railways, and bridges [5]. The basic purpose of modelling or simulation of these dynamic phenomena is to help out decision makers to have a better understanding with the nature of disaster in terms of risk assessment and damage reduction [6]. So far, modelling at the subject was performed within 2D software applications. As a real world is three-dimensional, study of dynamic behaviour of catastrophic events, vulnerability and risk to land and people demands incorporation of the third dimension. Thus, SketchUP as 3D software application was used for the purpose of real world's objects modelling.

SketchUp is a powerful 3D modelling computer tool, commonly used by architects, designers,

Figure 3.   Hazard threat zones implemented in QGIS project

Figure 4.   3D models of buildings made in SketchUp by students

builders and engineers. It is available to the users in a freeware version and in a professional version, with additional features. Although the free version does not provide equal opportunities as pro version, it offers incredible opportunities that meet our needs and its user-friendly interface design, as well as its environment, make it easy to use. SketchUp enables placement of its models within Google Earth and to the 3D Warehouse database - an online open source library of free 3D models for public distribution. The program also supports software extensions and plugins that add diversified features and specialized functionality to SketchUp application.

DRM&FSE students use SketchUp for vulnerability assessment of structures, through defining attributes and parameters that contribute to the vulnerability level, and then creating a photorealistic spatial model of the built environment with the associated attributes (Fig. 4). These attributes interact with each other and relate to the building type, number of users, building position, time of construction, geometry, shapes, number of floors, foundations, structure, used materials, evacuation elements, maintenance, surrounding utilities, etc. Attributes are being attached to the model depending on the level of detail desired in the modelling process, based on the disaster type, and can be changed by the user when building the scene. Students obtain field photos of each building and then use them to texture the exterior of the 3D buildings providing a realistic representation of the models. These models also can include 3D information on the interior, such as features within the building - rooms, stairs, elevators, evacuation corridors and so on, facilitating better evacuation planning, analyses of fire load, etc. Also, if the model is not possible to set correctly to the scene, SketchUp enables creating or modification of existing Digital Elevation Model (DEM) of terrain.

SketchUp provides an interactive, 3D environment and allow us to "walk" through the virtual structure, observing the construction, exteriors, interiors, fire safety elements, etc. For example, within fire load survey, 3D model of the building created in SketchUp can be used to better visualize relevant dimensions and spacing of combustibles in the rooms. Also, SketchUp models can be used to recreate a certain fire scene in three dimensions, or to assess vulnerability to fire of existing high-rise buildings' models. SketchUp is also compatible with other programs that enables, for example, 3D modelling of flooded buildings and infrastructure, in order to aid visualization when making a decision when the buildings in the flood zone may be safe for people to occupy.

It can be concluded that SketchUp is an open source tool for 3D modelling which can provide input for decision making in disaster risk management field. Also, its 3D graphical representations significantly increases risk awareness among decision makers and, thus, improves their efficiency.

V.   PATHFINDER

Another tool that could increase risk awareness and force evacuation planners to rethink and reiterate evacuation time estimates is Pathfinder. During the teaching process at the subject Modelling and Simulation in Risk Management, for creating 3D models of the interior environment and evacuation modelling Pathfinder software application was used.

Pathfinder is an agent based egress and human movement simulator. It provides a graphical user interface for simulation design and execution as well as 2D and 3D visualization tools for results analysis. Pathfinder includes a graphical user interface that is used primarily to create and run simulation models [7]. Pathfinder is built on the idea of creating floor
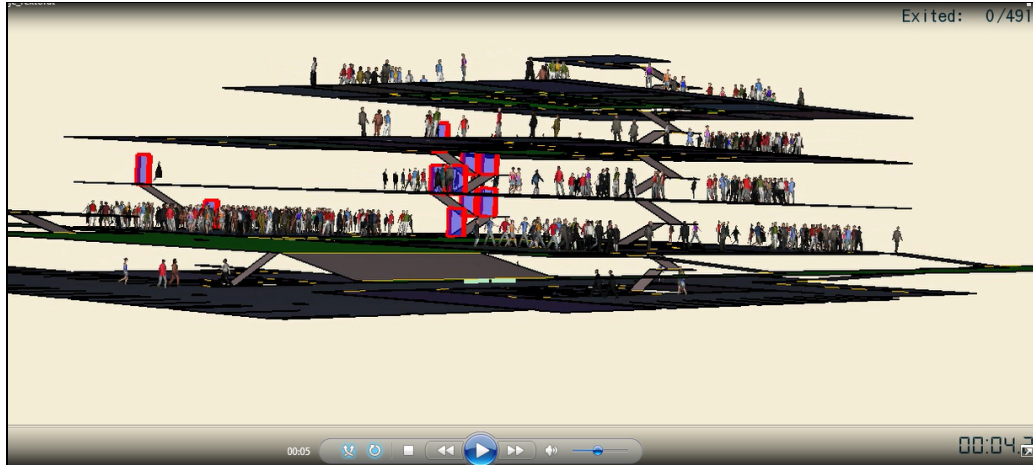
Figure 5.   3D time history

space on which occupants can walk. Every navigation component drawn in Pathfinder is some piece of flooring that can be travelled on, which can range from floors, to doorways, to stairs. The movement environment is a 3D triangulated mesh designed to match the real dimensions of a building model. This movement mesh can be entered manually or automatically based on imported data. Pathfinder can import a large number of image and CAD formats. Imported files can be used as an aid to more quickly generate the navigation mesh and give more context and visual appeal to a simulation [7].

Input parameters for the modelling in Pathfinder are divided into two groups: environmental features of interest and characteristics of the participants (occupants). Environmental characteristics include building use, building area, number of floors, egress components (e.g. stair design and location, zoning elevator, number and position of the sky-bridges, etc.). Characteristics of occupants are primarily related to the possibility of timely reaction and movement (speed, direction of movement, casual retention etc.). Each occupant is defined by position, a profile that specifies size, speed and behaviour that defines goals for the occupant. The behaviour defines a sequence of actions the occupant will take throughout the simulation, such as moving to a refuge area, waiting, and then exiting [7].

Based on the defined characteristics of an objects and persons, software performs the appropriate calculations, and as a result gives information about the time required for all persons to leave the building or the affected area. An example of 3D results of software is shown in Fig. 5. In addition to 3D visualization, Pathfinder also provides output in the form of a 2D time history plots of CSV output files and a text summary of room clearing times and doorway flow rates [7]. An example time history plot can be seen in Fig. 6 and Fig. 7.

Analysing obtained results, it is possible to identify critical points in the real system that causes reduction of efficiency and effectiveness of the evacuation. Also, it is possible to identify appropriate solutions with the purpose of enabling the smooth performance of the evacuation process. Accordingly, the applied information technology for the evacuation examination represents useful tool for designing disaster risk strategies.

VI.   CONCLUSION

Presented software applications were selected with the aim to develop problem solving skills
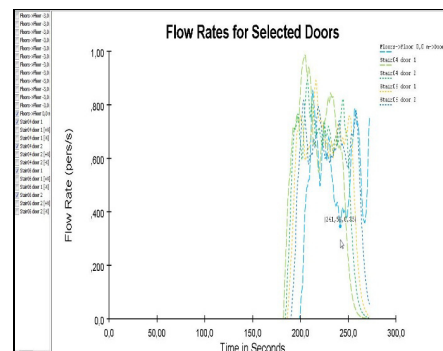
Figure 6.   Door flow rate
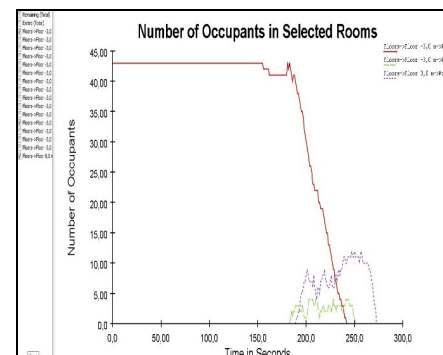
Figure 7.   Room usage

among students, by motivating them to create their own case studies and to analyse hazards of interest. Also, real system modelling and simulation is conducted with the idea of overcoming lack of practical experience in our educational system. During realization of their tasks students become aware of the relations among elements within system and existing and possible processes between these elements.

Additional advantage of the reviewed software applications selection is that each is spatially enabled and processed data within each application could be interconnected and organised within backend spatial database. Spatial database is an inevitable element of the spatial data infrastructure which is necessary for any disaster management process.

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Chatbots and Possible Applications

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Abstract - **The paper deals with a type of conversational agent, a computer program designed to simulate an intelligent conversation with one or more human users via auditory or textual methods. Some of them are designed for specific purposes, while others converse with human users on a wide range of topics. The purpose of this paper is to investigate the possibilities of applications in customer service in bank.**

I. INTRODUCTION

Chatbot is a computer program designed to simulate conversation with a user – human, especially over the Internet. It is often said that Chatbot is like a tennis game: question, answer, question, answer…[1]. Chatbot can be used in many ways and with numerous purposes. First, the purpose of the robot has to be defined, and on basis of that the adequate knowledge is embedded into the robot. There is higher-class artificial intelligence like, for instance, Google DeepMind AI (Artificial Intelligence), which require supercomputers of great capacity. However, given that people focus their attention to various areas, it is not bad to make a robot customized for several areas. In that case, the programmer has the duty to embed as many useful pieces of information in the robot in order for the end user to get as accurate and helpful answer as possible.

By directing the robot to learn and expand its knowledge in an area enables easier programming of the robot. No matter how the robot's algorithm is complex, it always stays within the area of knowledge and we always know, as a program or as a user, how to formulate the question. In addition to it, we can use the words which are actually expected, since we know the area in question.

If for instance we take banking, customer service specifically, we can teach the robot to recognize the customers' requirements and on the basis of these, give an appropriate answer. The bank employees work directly with the clients and all telephone communication takes their precious time, and the time of the clients who are waiting to be served. Today, banks have their websites with a lot of information, but it is fairly frequent that the information is not placed on the site in a meaningful way, so the client finds it really hard to find the piece of information they need. Therefore, a robot can be made and provided with basic knowledge in the form of word and sentence algorithm for recognizing, as well as the database of clients and other important information, for instance, on the bank itself.

The process of robot's functioning would be simple:

1) Asking the robot by the client, in the form of a sentence

2) The robot extracts recognized keywords from the sentence

3) Using the spanning algorithm, the robot finds the only solution

4) The solution is written in a sentence provided by the programmer

The robot's answer can give us none, one or more than one information. In the case of one information, the robot which has not succeeded to find an adequate answer due to lack of key, i.e. recognized words, an error occurs. If only one word is recognized, which is insufficient, the robot can display a possibly incorrect piece of information. In the last case, we have a complete answer if the robot successfully finds all the required words.

A well-programmed robot should not display an error due to lack of information. Instead of the error, the programmer should insert any answer, i.e. prepare the robot to have an answer to all questions, even though the answer is - another question to make the user repeat or rephrase the question more precisely.

A. About the graph

If we wish to program our robot, we need an algorithm for the robot to 'think within'. Hence, we need to create a graph for the robot to use while making the paths to the final answer, on the basis of

questions. The graph consists of nodes and connections (edges) between the nodes. On each node, the robot has one or more options to choose the path - the options are in fact the keywords, which the robot recognizes from the user's question. If the robot cannot identify the path to follow, there is always the default path specified by the programmer, but the answer obtained in this way is less precise.

The robot can be programmed without the previously designed graph, but it is much more difficult in this way. The interpreter will generate the graph by itself, based on the program code. However, in order to monitor the robot development and enable constant upgrading, it is more than favourable to create the graph. There are a lot of ways to program the robot, as well as a lot of program languages; the one presented in this paper is called AIML, abbreviated from Artificial Intelligence Markup Language.

Figure 1. Gives the example of an AIML graph generated by interpreter.
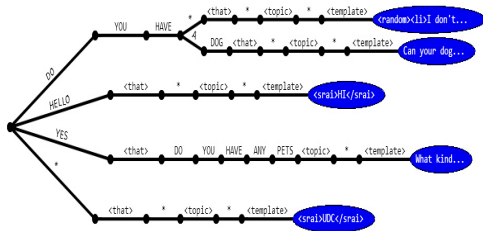
Figure 1: AIML graph [9]

II. PREVIOUS WORK

Since the emerging of AIML, a number of really good chatbots has been created, some of which won the Turing Test prizes. Loebner Prize is the first formal institution for the Turing test, organizing competitions in the field of artificial intelligence. [2] A chatbot named 'Mitsuku' won was in the first place in the competition finals in 2015, with the result of 83.33% [3] and the basic language used for creating the chatbot was AIML itself. 'Mitsiku' chatbot was ranked second in 2015, but in 2013 was first. [4]

This chatbot creator is Steve Worswick, who said that he had been making 'Chatbot' for about 10 years, dedicated an hour each night to this. What makes 'Mitsuku' different from other AIML language-created chatbots, is the large database of words-objects with attributes. Therefore, for instance, the question 'Can you eat a tree?', 'Mitsuku' will search the attributes of the object

'tree', more precisely, the attribute 'made_of' and answer negatively since the tree is inedible. This method is really useful for nonsense questions like 'What is bigger, tree or banana?', which the competition referees like asking the chatbot. [5]

A similar question was asked to chatbot named 'Izar', which won the second place in 'Loebner Prize' competition in 2014. The question was: 'Which is bigger, a cat or a kitten?', and the chatbot answered: 'On my planet a cat is bigger than a kitten. I'm assuming it's the same here on Earth unless you are weird'. [6] 'Izar' is also a chatbot made using AIML, powered by Pandorabots. It is interesting that 3 out of 4 best-ranked chatbots in the same competition, held in 2013, were created using AIML language. The fourth one is chatbot named 'Rose', and it uses ChatScript [7]. Next year, 2014, 'Rose' is winning the competition with 89.17%, whereas 'Izar' was second, with 88.33%. [8].

III. AIML LANAGUAGE

AIML is a markup language, i.e. a language that uses tags, enabling easier programming, since the syntax is really simple. AIML code can be written in any text editor, but there are also specially designated softwares as well. Pandorabots is a service which officially continued developing the AIML language, and their website has a text editor, adjusted for entering AIML. Anyway, any text editor can be used for doing this, and one of the frequent solutions is Notepad++ or Sublime Text.

A. Software for writing AIML code

If we wish to have help from the software for writing AIML code, we can use any software for creating XML code, i.e. any type of Markup Language files. In this way, the software will help us by finding the parts of code containing errors, for instance, an unclosed bracket or similar.

However, in order not to type the entire code manually, there are tools enabling to program the chatbot's 'brain' through interaction with it. They are visually well designed and we can create a new 'thought' in just a few clicks.

B. Some of AIML interpreters:

Program Z – online tool, the only one continuing and supporting the version 2.0 of AIML language. Official tool on pandorabots.com, and the only tool necessary to create the most advanced chatbot in AIML language.

Program D – Java-based interpreter. It is discontinued, but there is one project which still employs it.

Programs O and E – two platforms for web environment, made with PHP language, using MySQL database. A great solution if we wish to embed our chatbot in a website.

Program R – AIML parser, written for Ruby. It still needs to be tested in detail, since it is still 'under construction' by a few developers.

Program V – Perl version of AIML interpreter.

Program P – Pascal version of AIML interpreter.

There are also a number of interpreters for AIML language, written in C# and C++, but they support the language up to version 1.0.1.

All the aforementioned interpreters read the tags and based on them and information provided with them, make a graph representing a 'brain' of the chatbot. Therefore, the proper use of tags is very important, and the chatbot complexity depends on the number of tags.

C. AIML tags

The tags are written in angled brackets - < and >, and there are open and closed bracket. When a tag is open, depending on its type, the bracket has or does not have to be closed. All the content between the brackets are in the form of words, letters, numbers and other tags. It means that the tags can be nested and relations parent-child can be made. An example of nested tags:

<template> A few words <star></template>

Where <template> is the parent to tag <star>. In this example, we can see the example of a tag which does not have to be closed, and it is <star>. The tag can be closed (in version 2.0 of AIML language's documentation, all tags have to be closed, which was not the case with the previous versions, but the interpreter knows what tags we do not have to close and therefore it does not report an error). Basically, the tags which do not contain information between their opening and closing, do not have to be closed and this makes the code shorter.

There are also some mandatory tags which we can use when neccesary, depending on the way we want to program our chatbot.

D. Mandatory tags

The mandatory tags are the one without which a chatbot's 'thought' cannot be written. The tags consolidating a single 'thought' are called 'category' and are written <category></category>. All the other tags are placed in between. Two more mandatory tags, belonging to tag 'category', are <pattern>, and <template>.

These are the three basic tags building a single 'thought' of a chatbot, but they need to have certain information. The information is written in the form of words, letters and other tags. A well-written chatbot code contains a large number of tags in the form of information, since it is exactly the tags in the form of information that give the complexity and higher artificial intelligence to the chatbot.

E. Information tags

These tags are used when necessary and there are enough of them to create a more complex chatbot. These tags can contain information on pathways, about the user, chatbot's 'personality', the person who the chatbot is talking to, variables, date and time and others. Information tags are crucial, since if used properly, they can ease the chatbot development and improvement of its intelligence. Onwards, we will describe only this type of tags, since they make 90% of AIML code, including the information held within the tags.

IV. AN EXAMPLE OF AIML LANGUAGE IN CREATING A CHATBOT - VIRTUAL BANK ASSISTANT

Chatbot can be used for various purposes, but we will see an example of its application within the field of banking, more precisely, its application as a bank assistant. To begin with, the chatbot's role shall be described.

A. Idea

The idea is to give the chatbot some basic knowledge, after which it could be expanded through conversation with the users. Our chatbot could learn about the user's identity in order to provide precise and any information at all. Therefore, the robot has to, before any action, get an algorithm (graph) to use when searching for answers. Then, based on the query, a static or dynamic answer should be given. The static answer is in form of a text that we give to the robot upon its very creation, for instance, the bank's phone number. The information is static because the user cannot influence it. On the other hand, there are dynamic answers, i.e. answers which vary from user to user. These answers are much more important, since they include mutual relations in order for the robot to find an exact piece of information requested by the user.

B. Learning the user identity

Prior to start explaining the way in which the chatbot learns about the user and gives him personalized answers, it is necessary to know at least some basic tags, which will be used for this purpose.

<set> and <get> tags

These two tags are very important in the process of programming the chatbot which will actually learn through interaction with the user. Basically, the tags serve to keep and display information on the user themselves during the very conversation with the user. SET tag serves for saving a value, and GET to read that value, i.e. use in the later conversation. For instance, if we wish for our chatbot to learn the user's name, we shall place the user's answer to the question 'What is your name?' into the SET tag, as follows:

<set name="name"><star></star></set>

In this way, we set the 'name' as a variable which will store the user's name, entered by the user themselves. Tag <star> is the replacement for any word, number, letter and is very useful, since it is dynamic - it replaces the 'thing' provided by the user. In this way, if the user enters 'Marko' as his name in the previous answer, the robot will place that word between <set> and </set> and therefore give the value 'Marko' to the variable 'name'.

If we want to use this piece of information later, we will use tag GET. For instance:

Good afternoon <get name="name"></get>!

The chatbot will display: Good afternoon, Marko!

As we can conclude, SET saved the entered name, and later we used it to personalize the message 'Good afternoon'.

<think> tag

Everything placed in <template> tag is visible to the user, as a print.

If we wish to hide a part, we can do it using the <think> tag. Why would we hide a part? As the very name of the tag suggests, it serves for the robot to 'think'. Therefore, if we wish to use the tag <set> and take the user's name as value. The name will be visible, but we do not want it to be. What we want is the robot to 'learn' something without us realizing it. It all happens in THINK tag. Example:

<set name="gender">male</set> Thank you for the information!

Displays:

Robot: male Thank you for the information!

Using this part of Code, chatbot learned the user's gender with the SET tag, but the value was written in the answer, which we did not want. Therefore, we need to use THINK tag.

<think><set name="gender">male</set></think>
Thank you for the information!

Displays:

Robot: Thank you for the information!

Therefore, what the user sees, is the answer 'Thank you for the information!' and the robot placed the value 'male' in the variable 'gender', without us realizing it.

<that> tag

This tag is very important, since it enables us a better control of the answers the chatbot will be giving. The THAT tag precisely sets the answer which the chatbot will give on the basis of the user's previous answer. This tag is easiest to understand through an example:

<pattern># ACCOUNT BALANCE</pattern><template>Enter your ID number</template>

<pattern>*</pattern><that>Enter your ID number</that><template><think><set name="idnumber"><star></star></set></think>Account ballance for ID number <get name="idnumber"></get> is 500 RSD</template>

Displays:

User: account balance

Chatbot: Enter your ID number

User: 12345678

Chatbot: The account number for ID number 12345678 is 500 RSD.

In this case, we placed the sentence 'Enter your ID number' between THAT tags, since it was the previous answer by chatbot, which now knows that if we enter the number 12345678, it is related only to the ID number, since in its previous answer, the chatbot requested it from the user.

<star> tag

This tag serves to give the task to chatbot to save the words written by the user in its 'brain'. Therefore, if the chatbot asks for the user's ID number using the (*) symbol, we can later make the

chatbot save this word or number instead of the (*) into the variable 'ID number'. The example is given in the code above.

<condition> tag for conditions

For any advanced chatbot we also need IF THEN and loops. In this way, the chatbot has more ways to reach various answers, and the answer itself depends on the communication with the user.

As the example, we will take a part of Code by which the robot displays the user's account balance:

```
<category><pattern># ACCOUNT
BALANCE</pattern><template>Enter your
ID</template></category>
```

```
<category><pattern>*</pattern><that>ENTER
YOUR ID</that><template><think><set
name="id"><star></star></set><set
name="idcheck">idexists</set></think>On your
account there is currently
<map><name>id</name><star/></map>. What else
would you like to do?</template></category>
```

Display:

User: Show me the account balance

Robot: Enter your ID

USER: 12345678

Robot: On your account there is currently 500 RSD. What else would you like to do?

In this example we see that, when asked for the account balance, the robot asked for the identification in the form of an ID number. Then it searched for the matching number in the bank database, and took the corresponding value. In our case, the number '500' is related to the ID number '12345678'. Apart from that, a part of Code

```
<think><set      name="id"><star></star></set><set
name="idcheck">id exists</set></think>
```

served to the robot to learn the ID number entered by the user, place it in RAM memory in order to use it again during the same conversation. In this way, the robot learned something about the user. This was mentioned in the section about SET and GET tags.

By the end of displaying the information, the robot asks the following question and in this way continues the interaction with the user.

Since the chatbot now knows the user's ID number, and the user asks 'When will I get my next paycheck?', the chatbot will now use the ID number

and find the information about the possible day of the payment. It is done with the following Code:

```
<category><pattern>PAYCHECK</pattern><templ
ate>
```

```
<condition name="idcheck">
```

```
<li value="idexists">On the basis of your previous
account statements, your salary should be paid on
<map><name>salary</name><get
name="id"/></map></li>
```

```
<li>Enter your ID number to check the date of your
next salary</li>
```

```
</condition>
```

```
</template></category>
```

```
<category><pattern>WHEN #
SALARY</pattern><that>WHAT ELSE WOULD
YOU LIKE TO
DO</that><template><srai>PAYCHECK</srai></t
emplate></category>
```

```
<category><pattern>*</pattern><that>ENTER
YOUR ID NUMBER TO CHECK THE DATE OF
YOUR NEXT
SALARY</that><template><think><set
name="id"><star></star></set><set
name="idcheck">idexists</set></think><srai>PAY
CHECK</srai></template></category>
```

Display if there is the ID number:

User: When will I get my next paycheck?

Robot: On the basis of your previous account statements, your salary should be paid on 5.5.2016.

Display if there is no knowledge about the ID number:

User: When will I get my next paycheck?

Robot: Enter your ID number to check the date of your next salary

User: 12345678

Robot: On the basis of your previous account statements, your salary should be paid on 5.5.2016.

Firstly, we created a 'thought' with the aim to check if there is 'knowledge' about the ID number, and if there is, the chatbot searches the date on which the salary should be paid into that account, for that ID number. If the chatbot did not learn the ID number prior to the communication, its answer will be the request for the user to enter their ID number. After entering the number, the robot 'secretly memorizes' it by using the aforementioned

<think> and <set> tags. Then it returns to the part of code where the existance of the ID number is checked and re-checks it using the <that> tag. Since the ID number now exists in the robot's memory, it displays the date connected to the entered ID number.

V. CONCLUSION

As it could be seen, chatbot is a trend to stay. Such programs are often designed to convincingly simulate how a human would behave as a conversational partner, thereby passing the Turing test.

They are typically used in dialog systems for various practical purposes including customer service or information acquisition. We described in the paper possible application in customer service in bank. In this way, with lowered costs in means of time, energy and money spent, the main requirement of contemporary economy shall be met – to have the right 'person' at the right place in the right time, equipped with the right knowledge and competence to do their job in the best possible way.

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Simple Web Tools for Interactive Communication with Customers Web Portal Application „MY LAWYER,,

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Abstract - The Internet is becoming the backbone of all the trends in information - communication technology. Web applications are increasingly dominant in the software market and this work shows that the administration and tools for the design and creation of Web applications and adapting to this trend. The paper describes the selection of a minimum set of simple tools for the design and development of an interactive portal.

I   INTRODUCTION

In this paper are available and cheap web tools that are required to produce any interactive web portal. Konkret described herein application called "my lawyer". Disclosed are needed WEB tools such as HTML, CSS, PHP, MySQL and CMS. In the practical part of the paper describes the process of creating and publishing web portal "my lawyer". Tool for Planning gateways is Joomla - content management system - CMS, a specific interaction with customers is done in PHP. This web portal is designed so that it can be used by any law firms or associations in real circumstances.

II   INTERNET AND DEVELOPMENT TOOLS

Segment Internet development, which is specialized in designing web presentations called web design. Web design is the skill of creating ways of presenting specific content to end users through web browsers. It can be seen as a subset of graphic design intended for development and styling of objects for use with the web presentation. Often involving multiple disciplines such as graphic design, photography, animation, typography, corporate identity, communication design, interaction design, marketing, etc.

The technologies used in the development of the Internet:

• Markup Language (HTML, XHTML and XML);

• Language Style Sheets (CSS, XSL);

• Coding on the server side (PHP, ASP, CGI, Java,.NET);

• encoding on the client side (JavaScript, VBScript, AJAX);

• Database (MS SQL, MySQL, Oracle);

• Multimedia (Flash, Silverlight).

Web presentations which in this case is dynamic and it changes the content of the various access ways.

A   Markup Language

Markup language is a set of notes that are used to describe how a document will be structured, fitted or formatted. This language is in the form of markup code that is used in computer systems to adjust and word processing.

The most famous example of a markup language that is used in the programming of the HTML (HyperText Markup Language). It is based on SGML (Standard Generalized Markup Language) language and follows many of the conventions used in the publishing industry to communicate printed works among authors, editors and press.

```
<!DOCTYPE html>
<html>
<head>
<title>Hello HTML</title>
</head>
<body>
<p>Hello World!!</p>
</body>
</html>
```

Example 1: Appearance HTML document

B   Language Style Sheets

Language stylesheet is a computer language used to describe a way of presenting structured documents,. The most famous language stylesheets that are currently using the CSS (Cascading Style Sheets). CSS are used to style documents written in HTML, XHTML or other markup language.

To structured document presented to the essential content of the document to apply a set of style rules such as colors, fonts, layout, etc. A set of rules called a style sheet styles. –

```
<!DOCTYPE html>
<html>
<head>
<style>
 body {color: red;}
 h1 {color: #00ff00;}
 p.ex {color: rgb(0,0,255);}
</style>
</head>
<body>
<h1>This is heading 1</h1>
<p>This is an ordinary paragraph. Notice
that this text is red. The default text-
color for a page is defined in the body
selector.</p> class="ex". This text is
blue.</p>
</body>
<p class="ex">This is a paragraph with
</html>
```
Example 2: The layout of HTML documents with CSS code

C. The coding on the server / client side

The coding on the server or client side (server-side / client-side coding) are developing technology in the Internet that allow generating dynamic content web sites. Typical representatives of the first technologies are PHP, ASP, CGI, Java, .NET, and other JavaScript, VBScript, AJAX. First Advantage technology is that the process is not dependent on the platform on which the user because the entire processing is done on the server, a request to the server and results processing server sent some standard protocol that is supported by most Internet browsers (eg. HTTP or FTP).

Both technologies are an important element of dynamic HTML because they allow web sites to be programmable,

```
<?php
$target_dir = "uploads/";
$target_file = $target_dir .
basename($_FILES["fileToUpload"]["name"]);
$uploadOk = 1;
$imageFileType =
pathinfo($target_file,PATHINFO_EXTENSION);
// Check if image file is a actual image or
fake image
if(isset($_POST["submit"])) {
    $check =
getimagesize($_FILES["fileToUpload"]["tmp_name"
]);
    if($check !== false) {
        echo "File is an image - " .
$check["mime"] . ".";
        $uploadOk = 1;
    } else {
        echo "File is not an image.";
        $uploadOk = 0;
    }
}
?>
```
Example 3: The appearance of PHP code

D Database

The database is a collection of data organized for rapid search and access data within the base are logically related.Users access the database, primarily through queries (query). Today, the most frequently encountered model of relational databases.

Databases are managed using database manager that allows administrators to define access rights (read / write) certain users, generate specific reports and perform analysis. Databases and managers are frequent in large systems, but there are also small and medium-sized systems. SQL (Structured Query Language) is a standard language for creating interactive query and update databases.

E. CMS

CMS stands for Content Management System and a system for managing web content that provides a wide range of tools for creating, editing, viewing and posting content such as text, images, videos and audio files. Since the CMS systems vary in capabilities, intentions, usability and performance, they can be divided into two basic categories:

CMS open source:

This category includes CMS systems such as WordPress, Joomla, or Drupal, and this is by far the most widespread category. Basic features are free use of the possibility of improving the system of user-CMS extension of certain functionality.The main advantage of using a system of this group is a blog (web site) is not related to the person or company that developed the site. Since this is the most popular group of CMS systems is not difficult to find experts to take over maintenance of the site.

CMS for specific purposes

These systems are developing specialized companies for a particular project. They are maximally oriented towards meeting the specific objectives of the project and are not intended for mass sales.

The advantages of using CMS:

• The ease of updating content. Adding content is greatly facilitated through the CMS system.

• Self maintenance facilities. Through CMS content can refresh, edit or delete whenever you want, at any time and from any computer that has an internet connection.

• The separation of content from design. Editing templates (backgrounds, eng. Template) - using a CMS you are able to change the templates and layout of your site

• Accessories that enhance functionality. By installing plug-ins (eng. Plugin) you can increase the functionality of your site.

• Support other users. If it happens that you do not understand a specific function within the CMS, you can always ask the question on one of the internet forums where they gather users who have given CMS.

• The content set within the database. The database is responsible for easy content maintenance.

III CONCEPTUAL WEB SITE ,,MY LAWYER ,,

Idea web portal applications, "my lawyer" is to allow clients to contact a law firm through the Internet instead of spending their time and money so you would personally come to the lawyer's office. Thus reducing the time it takes to party get in touch with a lawyer. Increases productivity because a lawyer can in a short period of time to obtain and review the demands of customers, and therefore increases the quality of legal services.

Based on market research through interviews with lawyers and law firms it was decided that the platform will be used for the basis of a site to which parts of the site that relate to the interaction with customers. For the basis of the site was taken Joomla CMS, part of the portal concerning specific communication users with a lawyer was developed in PHP. It provides complete control over the information that the user needs to enter into forms to make their requests and questions forwarded to an attorney.
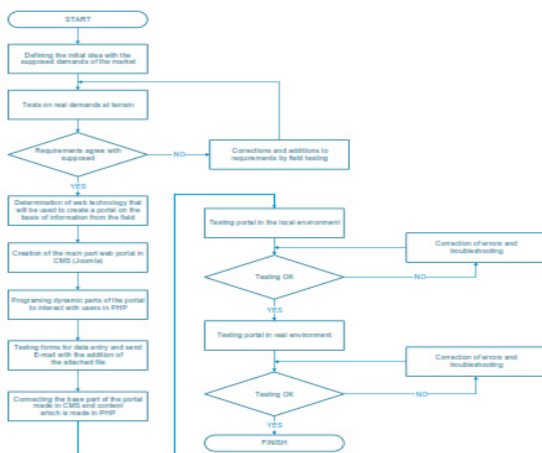
A. The folder structure for storing applications

The folder structure for storing applications is defined largely by the Joomla CMS, because it is used as a basis. The files that make up the web portal are arranged into folders corresponding to the predefined rules by CMS. For example, files that enable administration of the portal are in the folder

administrator, the images shown on the website is in the folder images, logs are in the logs, templates folder to display templates and so on.

B. The program basis

Web technologies that are used to display dynamic content on the Internet requires that certain programs and services are installed on the server on which the web portal is located. First and foremost you need to install the Apache server. Considering that the Joomla CMS based on PHP code and a dedicated content that is used to interact with users coded in PHP, you need to install and support PHP. Next it is essential for the functioning of the MySQL database. It is used for storage of all data related to web portals. To web portal to function in the local environment (on a computer in a law firm that has a permanent connection to the Internet), it is sufficient to install WAMP package (if it is a Windows operating system) or XAMP (Linux operating system).

If you want to set up a web portal on a server from a hosting provider (Orion Telekom, Verat.net, EUNET Hosting, AdriaHost and others.) Is enough to select a hosting package by the providers themselves take care to ensure that all the necessary software and services are installed and upgraded the latest version in order to reduce the possibility of unauthorized access to the site and changing his content.

C Programming language PHP

To create a web portal applications, "my lawyer" used the PHP language for various reasons. PHP is a scripting language designed for use on the web and that is why it is working on servers, not on the user's computer. Can be used on most web servers and in almost all operating systems and platforms, and is free of charge. It is suitable for the development of advanced web applications that include web development shop's, internet portals, forums, sites specializing in internet social networks (Facebook, Twitter, Google+) and the creation of CMS's (Content Management System - Joomla, WordPress, etc.).

IV MAIN MASK - JOOMLA CMS

The main mask web portal applications, "my lawyer" was created in Joomla CMS. Figure 1 shows the appearance of the main mask of the portal
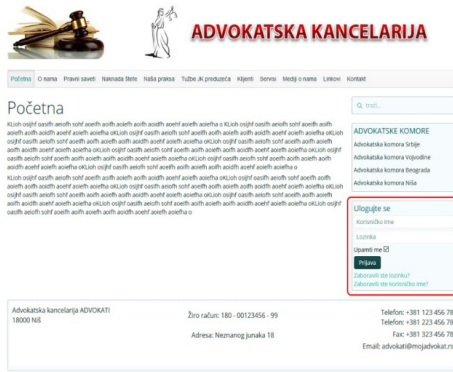
Figure 1: The layout of the main mask web portal

A   Software routines

To explain software routines written in PHP will pass through the web portal applications, "my lawyer" on a more detailed way. We'll explain some important segments of web portals that are important both for the users of the portal (lawyer - operator) and for clients who use the portal to contact a lawyer or law firm.

The first screen encountered by users is the main mask is shown in Figure .1. It shows the log in form through which a user portal (Lawyer - operator) logs and the team gets the opportunity that sets the initial parameters of the portal to add, delete and modify content.

By entering a user name and password in the login box, and clicking on the button Login user logs on to the portal as an administrator and has the rights to perform the initialization of initial parameters, adds, changes and deletes the content as desired. After logging in the lower right field appears the portal administrator believes that there are two items: Initialization and Log files.

When the user first accesses the portal it is necessary to log in and perform initialization portal. After logging in, and clicking the link in the Administration Initialization menu opens his mask with form for filling parameters for initialization. The initialization parameters include the following: name of the law office, city, ZIP code, address, telephone, fax, bank account, e-mail address, tariffs for criminal, civil, van civil, labor, administrative and other procedures - disputes. In the program routine that handles data from the form explores the variables that contain the fields to enter phone numbers, so that in the footer of the portal to show only those fields in which to enter phone numbers.

Figure 2. mask to enter initial parameters of web portal

After entering the initial parameters necessary to record the state data from the form fields will be stored in a file on the server where it is hosted by the web portal. Immediately all the other PHP procedure reading the file and take the information out of him that accommodations in the variables to make them appear in the right location within the portal. After entering the initial data in the form and recording procedures PHP handles data supervise them serializaciju and records them in a file inicijalizacija.iii. An example looks like this file can be seen in Listing 4.

```
a:15:{s:5:"naziv";s:27:"Advokatska
kancelarija
TEST";s:4:"grad";s:9:"Kruševac";s:13:"posta
nskibroj";s:5:"37000";s:6:"adresa";s:19:"Ma
rka Markovića bb";s:8:"telefon1";s:13:"065
65 65 655";s:8:"telefon2";s:13:"066 56 56
566";s:9:"ziroracun";s:13:"100-000208-
28";s:3:"fax";s:11:"037 403
123";s:5:"email";s:13:"test@test.com";s:8:"
krivicni";s:4:"5000";s:8:"parnicni";s:4:"25
00";s:11:"vanparnicni";s:4:"2000";s:9:"radn
ispor";s:4:"1000";s:7:"upravni";s:4:"1500";
s:6:"ostalo";s:3:"500";}
```

Listing 4: Listing files inicijalizacija.iii

In Figure 3 we see the appearance of footer web portal applications, "my lawyer" after the execution of initialization.

Figure 3. Appearance footer web portal after initialization

After initialization web portal is ready to welcome clients who need advice or assistance of a lawyer. Law Office can be contacted via the contact form located on the CONTACT link or via the form located at the link Ask a lawyer. Once the client fill in the contact form, the data is sent to the Email address that was entered in the form of initialization.

Figure 4. Appearance contact form

Another way, which is the most important, in which the client can contact the law firm is using form which is located on the link Ask a lawyer. Figure 5 shows where the link in the menu of the web portal. By clicking on the above link client comes to the portal page that displays a form for entering data concerning the questions and the specific areas in which these issues are related by the client. The mask patterns shown in Figure 6.

Figure 5. Position the link on the menu Ask a lawyer web portal

Figure 6. The appearance of the contact form from the link Ask a lawyer

Form from the link Ask a lawyer includes the following elements that are clearly visible on the screen shown in Figure 7.

On the server that hosts the web portal there are two text files: the date and counter. The file date is the date of the current day. It is updated so as, at each loading forms, checks whether the current date is the same as the date contained in the file, if so, then the current date is used to it is added to a figure that is in the file counter and in that way to form a reference number. But if the date in the file date other than the current date, then the current date is entered in the file and so you can overwrite the existing new one, a figure from a file counter is set to 1. Since the reference number unique to each hit form then on after completing and submitting forms automatically entered in the payment slip that shows the client, and that he pays for the service that you requested from the lawyer's office. In Figure 2.6.7. shows the format calls to a number that is made up by a combination of date and counter.

Figure 7. The format calls for the number of forms from the link Ask a lawyer

Figure 8 shows the appearance of the payment slips, inscribed with the reference number, the client has to fill in and paid according to the following figure

Figure 8. The appearance of interactive payment slip

When behind the above-mentioned forms has two functions. The first is to compare the current date with the date in the file date and on this basis to generate a reference number. The second function is

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to generate forms for data entry and after clicking on dubme Send this information to forward the file uplatnica.php that needs this information to process, send email to the specified address and displays a money order to the client.

As regards the form, all the fields except the field for a reference number are available for data entry. In the reference number is automatically entered izgenerisan number and this field can not be edited so as not to accidentally change its content.

Content money order is entered in the file uplatnica.php Its function is that the data that is received from the previous form of the check invalid characters (Email, file that is associated with the form) all information forwarded to the office of advocacy in the Email that previously defined initialization and the client displays the payment slip with reference number. PHP programming sequence checks that all fields that are marked as required limited in how many prints you are not a mistake and expects the user to fill them, otherwise go on to execute code. Examines the Email address that was entered in the form of the unusual characters to prevent someone deliberately try to insert malicious code. If the email contains illegal characters, prints the error expected from the user to enter a correct email address, otherwise it continues with the execution of code.

List of tariffs, which are entered in the initialization is shown in the link Tariffs of our services (Figure 9).

Figure 9. Appearance cats showing rates (outlined in red).

At the beginning of the code that loads the tariff, listing 5 inicijalizacija.iii loads the file and from the data collected and classified into variables, the following files are printed within the HTML code to display in the browser.

```
<!DOCTYPE>
<html>
<head>
    <meta http-equiv="Content-Type"
content="text/html; charset=utf-8" />
```

```
    <link rel="stylesheet"
href="/mojadvokat/templates/yoo_nano3/sty
les/turquoise/css/theme.css">
    <link rel="stylesheet"
href="/mojadvokat/templates/yoo_nano3/css
/custom.css">
    <title>Futer portala</title>
</head>
<body>
<?php
// inicijalizacija fajla
$fp = fopen('inicijalizacija.iii', 'r');
// citanje iz fajla
$infotxt =
file_get_contents('inicijalizacija.iii');
$info = unserialize($infotxt);
extract($info); // izdvaja text i stavlja
u varijable redom !
?>
<h2>Tarife usluga prema vrsti
predmeta:</h2>
<p><br>
<table width="200" border="0"
cellspacing="5">
    <tbody>
    <tr>
        <td width="100">- Krivični</td>
        <td align="right"><?php echo
$krivicni; ?></td>
    </tr>
    <tr>
        <td>- Parnični</td>
        <td align="right"><?php echo
$parnicni; ?></td>
```

Example listing 5. Part code file tarife.php

When the administrator is logged in the bottom of each article that is on the web site, there is a link Izmeni.Klikom on that link opens an article that has an interface similar to Microsoft Word to allow the amendment of the article without the need for programming knowledge (Figure 10). From this screen it is possible to modify, add or delete text, add or delete the image, set up on the server that is hosting the portal.
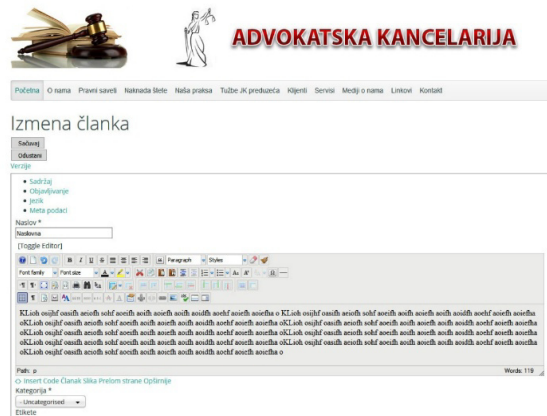

Figure 10. The appearance of the screen on which it is possible to shift content articles portal

And finally on the right side of the bezel just above the login fields are links bar associations that are loaded in the iframe so it does not go beyond the

contents of a web portal that is the link is fully displayed as it was originally

Figure 11. Link Bar Association of Serbia

V   CONCLUSION

The existence of a large number progrmaskih Web tools rather confusing to many developers who would želelei to work in a Web environment. This work has the purpose to show that in a relatively simple way it can with the help of a simple program units and free tools came to a successful implementation of a very modern interactive Web portal. Application Jomi, PHP and MySQL and allows even beginners to easily and quickly devices such interactive application online

The work is especially potentiated PHP language with the confirmation of its flexibility in use, ease of coding and power to manipulate data.

As for the issues I dealt with application context, this paper, through a web portal applications, "my lawyer," we say that in this area there is a big gap in the use of web technology, using this web portal law firms will be able to receive and processing a much larger number of client requests than the traditional way a client will, within a few minutes be able to get an answer to your question, or within, say, one day, a motion for a court or an appeal, a complaint which is certainly the goal of a modern information society .

Specific applications -portal can be found at: www.advokatjovovic.co.rs

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Visualization of XML as a Graph

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Abstract – In this paper it is shown a possibility of using XML file to visualize graph, including a review of a few extension of XML format for graph works. Especially it is shown GraphML language. Nested graph is shown in the example.

I. INTRODUCTION

Despite the fact that there has been many tools developed to deal with relation data (to both store the graph data for visual representation as well as the relations themselves), there has not been any widely accepted standard, and functionality of those tools were limited to their own scope and data was not compatible between different tools.

With a goal to introduce a method of dealing with said problems and demands, that is capable to be compatible and easily portable to different tools and platforms, the Steering Committee of the Graph Drawing Symposium started initiative with informal workshop that was held in conjunction with 8th Symposium on Graph Drawing [1].

As a result, group managed to form a new format for modern graph exchange, GraphML, which is suitable for data transfer between graph drawing tools and the applications that use the graph [2].

Next to the aforementioned Graph Drawing, there are others as well:

- Graph Modeling Language (GML) is a file format, based on hierarchical ASCII and used for describing graphs. Its other name is Graph Meta Language. The most important characteristics of this modelling language are portability, simple syntax, extensibility and flexibility [3]. The files written in this language, so-called GML files, are made up of hierarchical key-value lists. Arbitrary data structures can be added as annotations to these graphs. After many discussions, the GD'95 saw the emergence of the idea for a common file format. Today, GML is the standard file format in the Graphlet graph editor system, having been overtaken and adapted by several other systems for drawing graphs as well [4].

- GraphXML — an XML based graph interchange format. GraphXML is a graph description language in XML that can be used as an interchange format for graph drawing and visualization. It should be possible to label graphs, nodes and edges, and attach application-dependent data and external references [5].

- XGMML (eXtensible Graph Markup and Modeling Language). This is an XML application for graph description, based on Graph Modeling Language (GML). The special feature of XGMML is the tags for describing graph's nodes and edges. The main purpose of this language is to enable the exchange of graphs between various authoring and browsing tools for graphs. The conversion of GML graphs to XGMML is trivial. When in this format, the translation of graphs to all different formats is possible with the use of XSL. The initial aim of XGMML was its use for the WWWPAL System that visualizes web sites as a graph. This is done by using so-called Web Robots, which navigate through a web site and save the graph information as an XGMML file. Like any other XML application, XGMML can also be mixed with other markup languages to describe additional graph, node and/or edge information [6].

- GXL (Graph eXchange Language): this is a graph (XML)-based standard exchange format used for sharing data between tools, as well as for reengineering. By its form, this language gives typed, attributed, directed, and ordered graphs, extended to represent hypergraphs and hierarchical graphs [7]. Due to its flexibility, this data model can be used for object-relational data and a wide variety of graphs. When using GXL, instance graphs can be exchanged

together with their corresponding schema information using a common Document Type Definition (DTD), which is a great advantage. The aim of this paper is to describe GXL and show how it can be used to enable interoperability of graph-based tools. This language has been widely accepted by reengineering and graph transformation research communities, and other communities are considering its adoption as well [8].

II. GRAPHML

GraphML has many characteristics from its root language, XML, and since it uses its syntax, the new format can be used in various combinations with other XML language formats.

First advantage is that it allows to attach <data> labels with more complex content for GraphML elements (for describing the visual aspect of graph in vector graphics for example), and second is that it can be integrated into other applications [9].

The goal of GraphML is to make a format that is able to represent graphics with additional data, including layout and graphics information and the data that is being stored does not interfere with representation of data from other applications.

GraphML is also designed with *Simplicity* (easy for a machine and humans to interpret and understand), *Generality* (no limitation on how the graph is displayed), *Extensibility* (possibility of expanding on features of format for more complex use) and *Robustness* (systems that can not fully handle all data should be able to extract the information that they can handle) in mind [9].

Graph Example Code in GraphML (Figure 1) defines graph in Figure 2.

```
<graphml>
  <graph edgedefault="directed">
    <node id="v1"/>
    <node id="v2"/>
    <node id="v3"/>
    <node id="v4"/>

    <edge source="v1" target="v2"/>
    <edge source="v1" target="v3"/>
    <edge source="v2" target="v4"/>
    <edge source="v2" target="v4" directed="false"/>
  </graph>
</graphml>
```
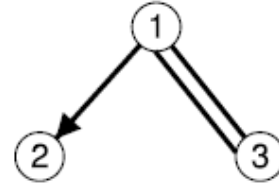
Figure 1. Example Code of GraphML defining graph below

Figure 2. Graph described in example

A. GraphML-XML document

Being related with XML, it shares its structure and how it is defined. XML are defined, in order to be valid, by declaring header which is either document type definition or an XML schema. GraphML has been defined by schema (Figure 3).

```
<?xml version="1.0" encoding="UTF-8"?>
<graphml xmlns=http://graphml.graphdrawing.org/xmlns
    xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
    xsi:schemaLocation="http://graphml.graphdrawing.org/
    xmlns
    http://graphml.graphdrawing.org/xmlns/1.1/graphml.xsd">
    <!--Content: List of graphs and data-->
</graphml>
```

Figure 3. Minimal valid GraphML document

First line in code in Figure 3., refers to XML version and encoding that is being used, in this case it is UTF – 8 (other encodings are also possible).

Second line contains root element which in GraphML is <graphml> and like all GraphML elements belongs to the namespace http://graphml.graphdrawing.org/xmlns. Next two XML attributes declare which XML schema is used for validation of this document.

The third line defines xsi as the namespace prefix for the XML schema namespace while the fourth one defines XML schema location for the GraphML namespace and it provides information that all elements in the GraphML namespace are validated against the file graphml.xsd located at given URL.

B. GraphML-Topology

In GraphML, a graph is represented by a <graph> element nested in <graphml> element, which may contain any number of <graph>s. Nodes of a graph are represented by a list of <node> elements and each node must have an *id attribute* . Edge set is represented by a list of <edge> elements. The order in which the edges and nodes are defined does not matter. Edge point to source and target nodes by the

values of their attributes source and target respectively.

Node-ids are unique within the enclosing <graph> and the attribute values of the source and target attributes match the id of some <node> within the enclosing <graph>, which is defined in the GraphML Schema specification. The edgedefault attribute of <graph> determines whether edges are defined as undirected or directed by default (which can be overridden be setting the value of their directed attribute to true or false).

C.   GraphML-Attributes

Even though pure topological information may be sufficient in some applications of GraphML, in most cases additional information is needed. That is achieved with GraphML - Attributes. With them user can add additional information (of simple type – restricted to scalar values; numbers and strings) for the elements of the graph. Please note that XML Attributes and GraphML - Attributes are two different concepts.

While GraphML - Attributes offer the ability to add additional information, in case custom data types are needed, GraphML language can be extended to include data in defined places.

One can view GraphML - Attributes as partial functions that assign values to elements of the graph. To add data functions to graph elements, GraphML key/data mechanism has to be used. A <key> element at the beginning of the document declares a new data function (it defines its id, name, domain and range values), while <data> elements define the values of the function (Figure 4).

```
<key    id="d1"    for="edge"    attr.name="weight"
attr.type="double"/>
```

Figure 4.   Example of Data Function

A GraphML - Attributes provides attributes for <key>, first being XML attribute called for which specifies the domain of the data function (which assumes values like graph, node, edge or graphml or even value all), second being attr.name (which defines name of the data function) and attr.type (which specifies range of data values; int, float, long, double and string being one of them) (Figure 5).

```
<edge id="e0" source="n0" target="n2">

   <data key="d1">1.0</data>

</edge>
```

Figure 5.   Code fragment defines value of 1.0 as weight for <edge>

GraphML-Parseinfo

GraphML - Parseinfo is another extension that makes writing simple parsers that rely on additional information possible in the GraphML files and is extension to core structural part of GraphML.

III.   NESTED GRAPHS

Nested graphs (graphs with hierarchically ordered nodes) are supported by GraphML. This language's document tree encodes the hierarchy tree. A <node> in a GraphML document may contain a <graph> element which itself contains the <node>s which are in the hierarchy below this <node>.

Figures 6 and 7 present a document in which a nested graph is described (example from [2]). The hierarchy is here expressed in the following way: if a node u is entirely inside the graphical representation of a node v, we can consider u to be below v in the hierarchy, i.e. to be contained in v. As presented in [2], when having a nested graph, the edges between its two nodes have to be declared in a graph that is an ancestor of both nodes in the hierarchy. The edge between node n3 and n2 inside graph G1 cannot be declared, but in graph G0, it is correct. It is smart to place the edges at the least common ancestor of the nodes in the hierarchy.

```
<graphml>
  <graph id="G0" edgedefault="undirected">
    <node id="n1">
      <graph id="G1" edgedefault="undirected">
        <node id="n3"/>
        <node id="n4"/>
        <node id="n5"/>
        <edge source="n3" target="n4"/>
        <edge source="n4" target="n5"/>
      </graph>
    </node>
    <node id="n2">
      <graph id="G2" edgedefault="undirected">
        <node id="n6"/>
      </graph>
    </node>
    <edge source="n1" target="n2"/>
    <edge source="n3" target="n2"/>
    <edge source="n3" target="n6"/>
  </graph>
</graphml>
```
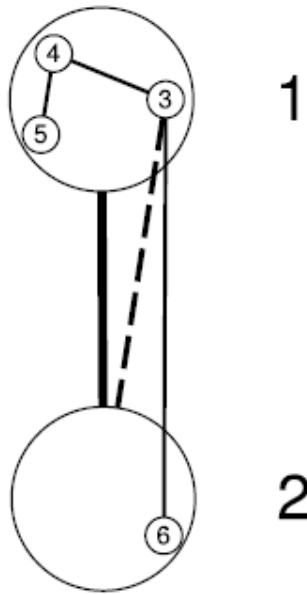
Figure 6.   Nested graph - code from [2]

Figure 7. Nested graph from [2]

The easiest way to read and write GraphML files is to use a graph-processing software: visone [10], yEd, Pajek, ORA and JUNG.

IV. CONCLUSION

GraphML and similar formats have become increasingly used in various areas of interest. There are still many applications and services not capable of processing them.

To be compatible, formats need to be translatable to each other, preserving as much information as possible. An important development is the synergy between graph drawing techniques and information visualization.

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