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CONTENTS

Foreword

The papers were selected at the ITRO conference as representative ones.

CLOUD SOLUTIONS FOR CREATING MIND MAPS USED IN TECHNOLOGICAL EDUCATION

UDC 159.953.2:004.72

Original research

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Abstract: The paper discusses the didactic and technological aspects of cloud solutions for creating mental maps. Mind Maps are seen as an adaptive tool for planning, organizing, creating, presenting, solving problems, such as communication and a method of memorizing information, making them a powerful tool for visualizing processes and occurrence studied in technology education.

I. INTRODUCTION

Cloud technologies incursion into education leads to the creation of new models of teaching and learning in an interactive and engaging learning environment. From a methodological point of view cloud technologies can be seen as an element of innovative culture, the manifestations of which have the potential to achieve competitive advantages, including in the education process as a whole, and in technological education in particular. From a didactic point of view, cloud technologies can be seen as a way to increase the efficiency of interactive interactions characteristic of the philosophy of technology learning, namely: "I have an idea", "think together" and "do together". As far as the teacher's knowledge, skills and competences are required to generate cloud solutions in educational practice, it is entirely reasonable to look at cloud technologies also in the context of his competence profile [1].

Cloud solutions for creating thought cards (iMindMap Cloud, MindMeister, Mind42 and Goggle) have an easy and intuitive interface and can be used in technologcal education to visualize ideas or concepts when working on projects, making technical objects and products as well and in the process of career guidance and counseling of students. Mind maps are an adaptive tool for planning, organizing, creating, presenting, solving problems, communicating, and memorizing information.

II. CLOUD SOLUTIONS TO CREATE MIND MAPS

Mind maps are an adaptive tool for planning, organizing, creating, presenting, solving problems, communicating, and memorizing information.

Technology

Each mind map begins with a concept placed in the center, which can be represented by a word and / or an image. It may contain visual elements such as circles, squares and other symbols, drawings or photos. Branches originate from a central concept and can be made in different colors and shapes. Each branch can be represented in many ways and linked to the other branches. Typically, one keyword is used for each branch when words are used.

There are many cloud technologies for creating both paid and free mind maps. MindMeister allows students to share and edit thought cards, leave comments and feedback, attach files, images, videos, and connect external or internal sources. Mind maps can be shared with classmates and teachers internally or externally through an email or hyperlink invitation. Mind maps can also be translated into interactive presentations.

The mind map created with MindMeister (Figure 1) serves to clarify the essence and stages in creating mind maps to visualize different concepts, processes and activities of technological education.

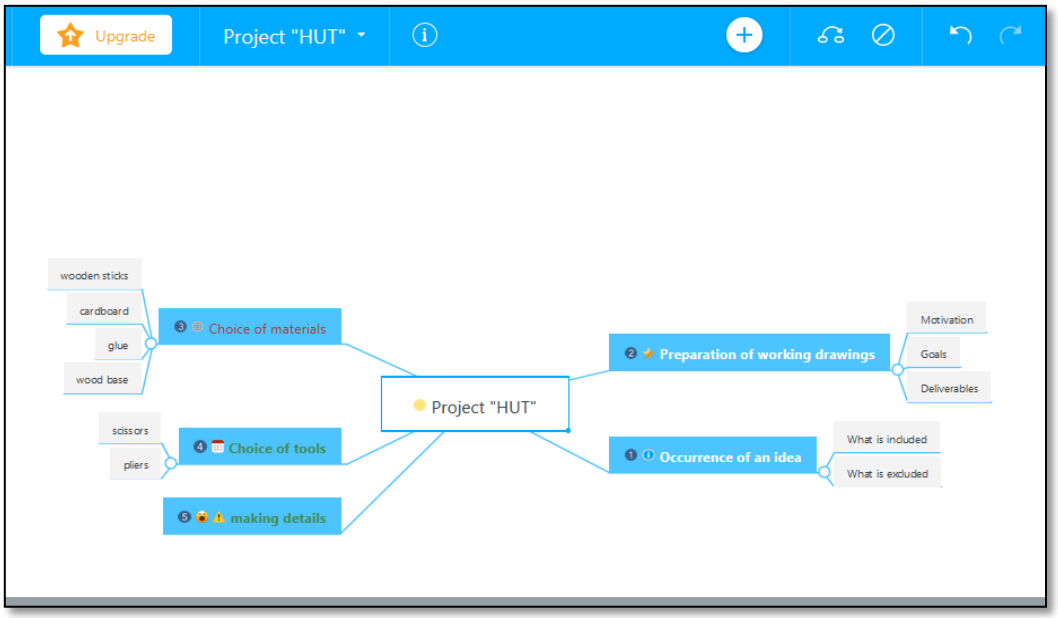

Figure 1. Project “Hut”

Another cloudy iMindMap Cloud solution (https://imindmap.com/) for visual thinking that can be applied to all cognitive functions, especially memory, learning, creativity, and analysis. Mind Mapping is a process that involves a combination of image, color, and visual-spatial alignment. The technique maps thoughts using keywords that trigger associations in the brain to trigger additional ideas. That makes it possible to work in a team when creating thought cards and working at any time.

With iMindMap Cloud you can solve a variety of educational tasks, discover new opportunities, organize, manage projects, teach, study, exchange information, and more. A Mind Map is a powerful graphic technique which provides a universal key to unlock the potential of the brain. It harnesses the full range of cortical skills – word, image, number, logic, rhythm, colour and spatial awareness – in a single, uniquely powerful manner. In so doing, it gives you the freedom to roam the infinite expanses of your brain. A Mind Map can be applied to every aspect of life where improved learning and clearer thinking will enhance human performance [2].

With iMindMap Cloud can solve a variety of educational tasks, identify new opportunities, organization, project management, teaching, learning, information exchange and many others.

Mind42 a web-based tool for creating simple, tight and schematic logos with a tree structure.

Mind42 has the ability to:

inserting images from URLs (i.e., images hosted on another site, such as ImageShack or Picasa);

URL links to external web sites;

Collaborate and edit in real time using the Google Talk gadget;

The mind map size is limited only by the available RAM and processing power;

possibility of publishing;

Ability to add notes to branches;

Export to Freemind, Mindmanager, Mind42 XML, PDF, image and rich text;

Import from Freemind, Mindmanager, Mind42 XML.

Coggle an easy-to-use minimalist online tool for creating thought cards when designing ideas or plans, the ready map can be shared online with other users with viewing and editing options.

To create a Coggle mind map just sign-in with your Google account and click the "+" icon to start your mind map. After entering the main idea of your mind map you can add branches by clicking the "+" icons that appear next to everything you type. To re-arrange elements just click on them and drag them around your screen.

The mind map "Technical Creativity" was created with Coggle in Fig. 4.

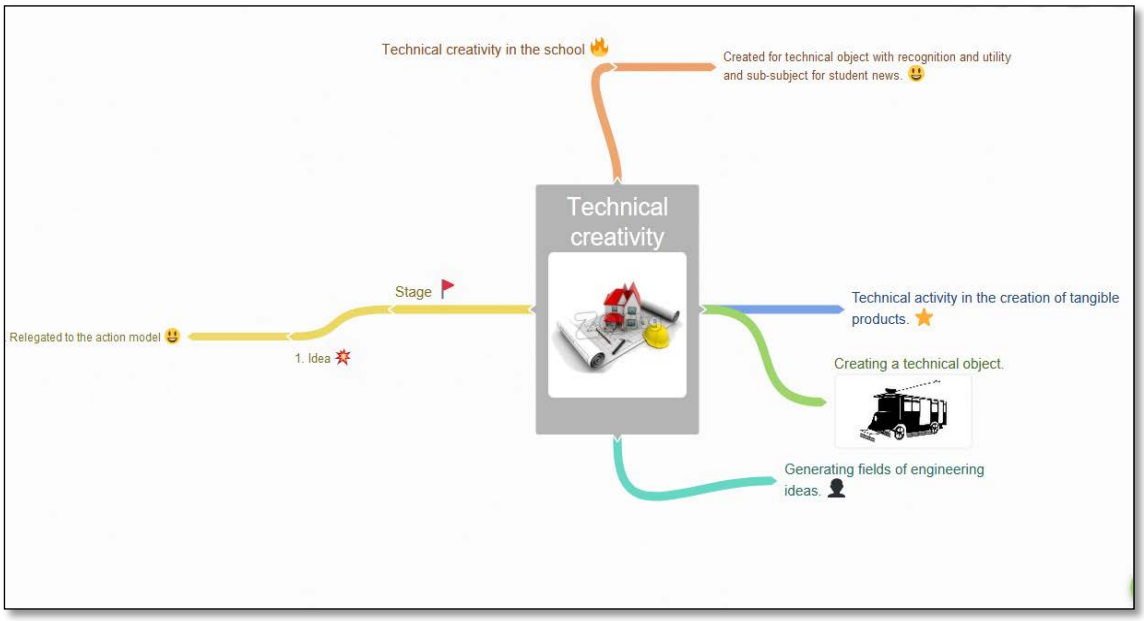

Figure 4. Mind Map "Technical Creativity"

Coggle is a collaborative tool. You can invite others to view and edit your mind maps. You can also just invite others to view by sending them an email through Coggle. All Coggle mind maps can be downloaded as PDFs or PNG image files [3].

III. CONCLUSION

Education cloud provides new opportunities for the development of technological education for the realization of the idea of lifelong learning and personalization of the learning process. Cloud technology and provides new opportunities for the development of education, for the individualization of the learning process. This can not replace teachers, but in combination with existing traditional methods can improve the quality of education. The integration of cloud technologies into technological education is conditioned by public needs and expectations for the modernization of the learning process [4].

Mind maps can be a useful tool in technological education that stimulates creative thinking of students, activates the absorption of new concepts and generate ideas. It is important to assess knowledge at the beginning of a topic and after to monitor your students understanding.

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IMPACT OF CHANGES IN THE CURRICULUM ON SUCCESSFUL ACQUIRING AND FOLLOWING OF THE CONTENT IN THE COURSE COMPUTER NETWORKS

UDC 004.41:378.016

Original research

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Abstract: Every faculty defines certain number of competencies that students who successfully graduate should gain. Every competence is a result of several well-structured and logically connected courses. Two years ago, certain changes were made in the curriculum of the Faculty of Information Technologies, with the goal of focusing on the field of software engineering because of the high demand for software engineers on the market. Previous curriculum had clearly defined line of competencies related to the field of communication technologies and the profession of system and network administrator. Curriculum modifications changed order of courses and sequence of presenting certain topics that are crucial in gaining competencies. This paper shows that the changes in the curriculum resulted in increased number of students with minimum knowledge in the field of computer networks and communication technologies.

I. INTRODUCTION

In today's world, there is a growing need for experts in the field of communication technologies especially of network and security administration. Previously, Faculty of information technologies had a curriculum that was well balanced between different fields of information technologies. Students who graduated in accordance with this curriculum gained equal knowledge in all IT fields. Requirements and different inputs from the labor market lead to modification of the previous curriculum in a way that now it focuses more on programming and gaining expertise in the field of software engineering. Following trends in IT, some universities developed software engineering centered curricula model for different study programmes, based on recommendations of WGSEET (Working Group on Software Engineering Education and Training) [1].

Existing structure (three-component model) and course schedule were changed in a way that some courses were transferred from fourth semester to second semester. Changes where not related only to the structure of curriculum but also affected the course structure in a way that course is now composed of lecture and exercise sessions – two-component model. Workshop classes are not part of the course any more, and workload is distributed between lectures and exercises. Workshop part of the course offered students chance to gain practical skills in the field of computer networks. In our previous paper we confirmed validity of the workshop component and its effect on students' understanding and knowledge [2].

These changes resulted in the following problems: overlapping of certain topics (binary logic, numbers systems, logical operation etc.), inability to follow lectures without previous knowledge and inability to gain certain knowledge and skills needed for further related courses.

Herbert, de Salas, states that first three steps related to curricula change should be: identification of career outcomes, definition of skills set, and desirable level of excellence in a certain field. [3]. Many authors recognized main factors in curricula changes [4] and some of them can influence curricula change more than others, resulting in disbalanced curricula structure.

I. PREVIOUS CURRICULUM STRUCTURE

Previous curriculum had a structure that guided student through the process of systematic gaining of necessary competences i.e. knowledge and skills in all IT areas. The following chart is showing a sequence of knowledge and competencies with regard to several courses and the way they are interrelated.

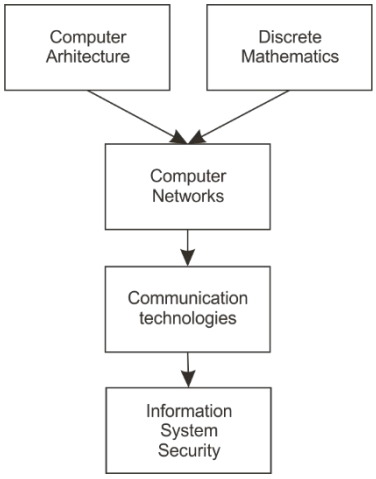

Fig. 1. Course enrolment requirements

In this course sequence, on the first year of studies, students learn basics about number systems, Boole algebra within the course Computer architecture, and as part of the course Discrete Mathematics they get knowledge about graph theory. On the second year, students have to use this knowledge to learn sub-netting technics that relay on number systems and their conversion, together with basic logical operations. In the course Communication Technologies students are taught about the functionality of routing protocols together with configuration steps and in order to gain that knowledge, students need understanding of graph theory from the previous year. The course Computer System Security and Protection requires from students to understand routing protocols and configuration steps, in order to acquire knowledge about advanced technics related to certain routing protocols.

When students passed the exam for the course that was a precondition for one of the following courses, it was a proof that students gained enough knowledge needed for the next course in the curriculum, and professor spent less time to revise topics covered in the previous course. Course sequence can impact student success and should be carefully defined. Slim et al. researched and showed influence of course sequence [5].

Every course used three-component model that combines lectures, exercises and workshop classes with balanced workload for a student, with total of 30 hours in 15 weeks. Duration of every session was 90 minutes with one or two breaks. Research shows that it is better to have shorter sessions with multiple breaks in order to achieve better results [6].

II. NEW CURRICULUM STRUCTURE

Modification of the curriculum resulted in transfer of the course Computer Networks to second semester. This course is now concurrent with the courses that were previously a precondition for taking the course Computer Networks. This means that Computer Networks, Computer Architecture and Discrete Mathematics courses are realized in the same semester. New course - System and Network

Administration was introduced on the second year and it is optional like the course Computer Networks. The following structural chart shows the modified curriculum.

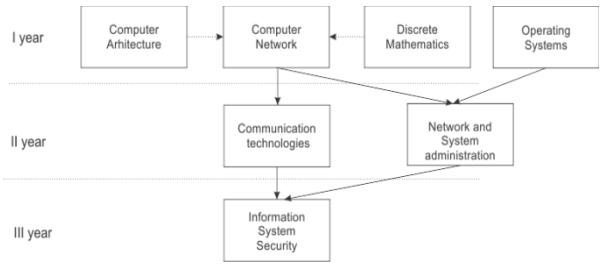

Fig. 2. Course enrolment requirements in the modified curriculum

We can see that there is a problem related to the fact that students cannot learn and use certain knowledge at the same time, especially if this knowledge is needed for gaining new knowledge. As an example, we will use conversion between different number systems. Students learn about number systems and their conversion together with logical operations in the period from 4 – 6 week as a part of the course Computer Architecture. In the 6th week of the course Computer Networks, students should be able to use this knowledge to do sub-netting of IP networks. Since students are not capable of doing this, professor must dedicate additional time to teach mentioned topics again. Even that is insufficient for some students who later have problems in following further lectures.

RESEARCH

This research is based on two curricula, previous and current curricula of the Faculty of Information Technologies in Mostar. We measured student success and percentage of students who passed the exam on two courses: Computer Networks and Communication Technologies. Research involved 870 students in three academic years (2013/2014, 2014/2015 and 2015/2016). Reference point was the academic year before any changes in the curriculum for those two courses were made, and both of them applied three-component teaching model. This model includes lectures, exercises and workshop classes. Course topics are covered during 15 weeks, once per week, with two blocks of 45 minutes with 15 minutes break. In 20114/2015 academic year two curricula were realized. That is because students who enrolled the Faculty in accordance with the old curriculum have a right to complete their education in line with that curriculum. In 2014/2015 academic year, we had 120 students enrolled in accordance with the previous curriculum and 297 enrolled in accordance with new one. Difference in the number of students enrolled in course is due to the change in the new curriculum where the course Computer Network was transferred to second semester of the first year and in the previous curriculum, it was on the second year and students had to fulfil certain preconditions in order to be enrolled in this course.

Computer networks - Curriculum 2013/2014

In the previous curriculum, this course had well defined structure of lectures and there were certain preconditions for taking the exam. In order to be eligible for taking the exam, student had to pass exam on the course Computer Architecture. Course included lectures, exercises and workshop classes.

Students could take exam through two partial exams or one integral exam. Students had the opportunity to do first partial exam in unmonitored conditions, i.e. at home or any other chosen location. Score of the first partial exam was accepted only if student managed to pass second partial exam the first time exam was taken. Second partial exam was conducted in controlled conditions and structure of the exam included 30% of content from the previous exam so students who passed first exam successfully and without any help, had to earn only 30% additional points to pass the exam. This was a way to determine how many students took this exam in a proper manner in unmonitored conditions.

Table 1. Results from first and second partial exams.

Date	Number of students	Passed	Failed	Percent of students who passed exam
30.11.2013	126	92	34	73,02%
28.1.2014	84	16	68	19,05%

Students who did not pass the first partial exam probably took this exam without any help and they make 26,98% of the total number of students. In the second partial exam, only 19,05% passed and that showed us that the rest of them possibly cheated in the first partial exam or they did not prepare sufficiently for the second partial exam. This showed us that applied exam model is suitable for around 46% of students (26,98 % students who failed to pass first partial exam and 19,05 % who passed the second partial exam). This led us to conclusion that it is better to organize the first partial exam in controlled environment and to make results from this first partial exam valid throughout the whole academic year.

Table 2. Results of all integral exam terms in the 2013/2014 academic year.

Date	Number of students	Passed	Failed	Percent of students who passed exam
28.1.2014	22	0	22	0,00%
11.2.2014	90	25	65	27,78%
28.6.2014	59	8	51	13,56%
3.9.2014	43	11	32	25,58%
15.9.2014	27	10	17	37,04%

Analysis showed that average grade for this academic year for the course Computer network is 6,38.

Computer Networks – previous Curriculum in 2014/2015 academic year

We analysed results of 143 students in 5 exam terms. Students took all exams in controlled conditions, and 35% of students passed the exam. In the second term (28.01.2014), 46,55% passed the exam, by taking two partial exams. There was an increase of 6% comparing to the previous academic year, when students took this first exam in uncontrolled conditions.

Table 3. Results from first and second partial exams in the 2014/2015 academic year

Date	Number of students	Passed	Failed	Percent of students who passed exam
27.11.2014	120	43	77	35,83%
28.01.2015	58	27	31	46,55%
11.02.2015	28	19	9	67,86%
26.06.2015	10	5	5	50,00%
04.09.2015	5	3	2	60,00%

Students who took first partial exam and failed to pass, in the following exam terms tried to pass integral exams. Table shows all students who passed the exam by taking one integral exam.

Table 4. Results of all integral exam terms in the 2014/2015 academic year

Date	Number of students	Passed	Failed	Percent of students who passed exam
28.1.2015	41	6	35	14,63%
11.2.2015	48	14	34	29,17%
26.6.2015	44	14	30	31,82%
4.9.2015	32	8	24	25,00%

If we compare number of students who took integral exam in the first term we can say that it is lower than we expected since there was 77 students who did not pass first partial exam, and that group of students missed one or more of the following exam terms.

Computer Networks – Current Curriculum - 2014/2015 academic year

In the current curriculum, the course Computer Networks was moved to the second semester of the first year. Table shows student achievements for partial and integral exams.

Table 5. Results from first and second partial exams in the 2014/2015 academic year

Date	Number of students	Passed	Failed	Percent of students who passed exam
16.4.2015	288	124	164	43,06%
17.6.2015	142	74	68	52,11%
8.7.2015	59	39	20	66,10%
16.9.2015	17	10	7	58,82%
2.10.2015	3	1	2	33,33%

It is interesting to see that all students tried to pass first partial exam and if they didn't not succeed they tried other options.

Table 6. Results of all integral exam terms in the 2014/2015 academic year

Date	Number of students	Passed	Failed	Percent of students who passed exam
17.6.2015	147	15	132	10,20%
8.7.2015	137	35	102	25,55%
16.9.2015	99	33	66	33,33%
2.10.2015	15	5	10	33,33%
10.2.2015	42	10	32	23,81%

Number of students increased because the Faculty enrols around 300 new students each year, and since this course is now on the first year of studies, all of them were eligible to take the exam.

Computer Networks – Previous Curriculum - 2015/2016 academic year

Since the new curriculum was introduced, there were no lectures based on the old curriculum, students did have access to teaching materials like online presentations, video tutorials and did not have the possibility to discuss certain topics with the teaching staff on this course. Since there were no lectures, student could only take integral exam.

Table 7. Results from first and second partial exams in the 2015/2016 academic year

Date	Number of students	Passed	Failed	Percent of students who passed exam
29.01.2016	11	3	8	27,27%
19.02.2016	8	3	5	37,50%
22.06.2016	7	2	5	28,57%
07.07.2016	4	1	3	25,00%
02.09.2016	4	2	2	50,00%

Total number of students who took the exam in 2015/2016 academic year was 34. Students who did not fulfil requirements for enrolment in the next year of studies, had to retake courses for which they didn't pass the exam. Since there were two curricula available for students, they could choose whether to reenrol in accordance with the new curriculum.

Table 8. Results from first and second partial exams in the 2015/2016 academic year

Date	Number of students	Passed	Failed	Percent of students who passed exam
22.06.2016	144	12	132	8,33%
07.07.2016	139	44	95	31,65%
02.09.2016	95	17	78	17,89%
15.09.2016	46	15	31	32,61%

Within this research, we also collected data about the course Communication Technologies. This is the next course in structure of gaining competences in the field of system and network administration. All changes in the course Computer Networks somehow reflect on student success on the course Communication Technologies. In the new curriculum, this course remained on the second year but in a different semester.

RESEARCH RESULTS

Previous curriculum 2013/2014

From the previous academic years with the old curriculum, we took academic 2013/2014 year as a reference point to track changes that were brought by the new curricula. We analysed percent of students who passed the exam during the above mentioned academic year. Results show 5 exam terms, and the first one combined results from the second partial exam and the first integral exam.

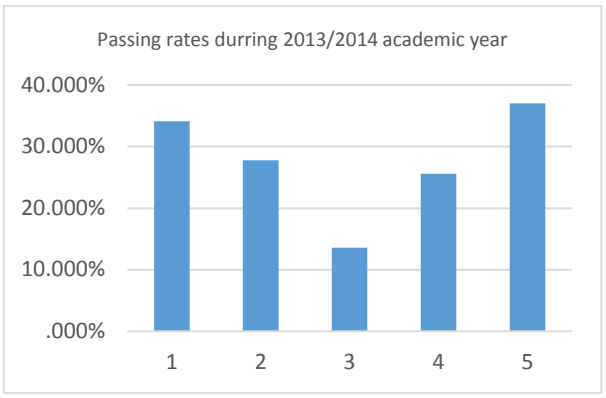

Fig. 3. Passing rates for every exam term in 2013/2014 academic year

Chart shows that the third exam term is the one with the smallest percent of students who passed the exam, which can be explained by the fact that students focused on other exams trying to pass them. By the end of semester, from total of 120 students, 110 (91,66%) of them passed the exam. This achievement distributed through exam terms is shown in the chart above. Student grades are in scale from 6 - that presents lower level of knowledge, to 10 - that presents the highest level of knowledge students can formally gain.

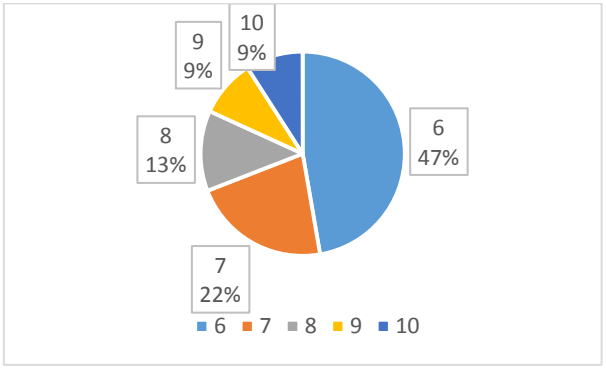

Fig. 4. Grades distribution for 2013/2014 academic year

If we analyse this chart we can see that all grades are present and quite equally distributed. Average grade is 6,379 and it scales from 6,76 to 6,25.

Computer networks – previous Curriculum 2014/2015

Students who did not pass the first partial exam had a different path of taking exams compared to students who passed the first partial exam. These students in equal number chose one of the following terms to take the exam. First results in the chart include all students who took the second partial exam (46,55%) and those who took integral exam (14,63%), and thus the percent of students who passed exam in the first term is smaller.

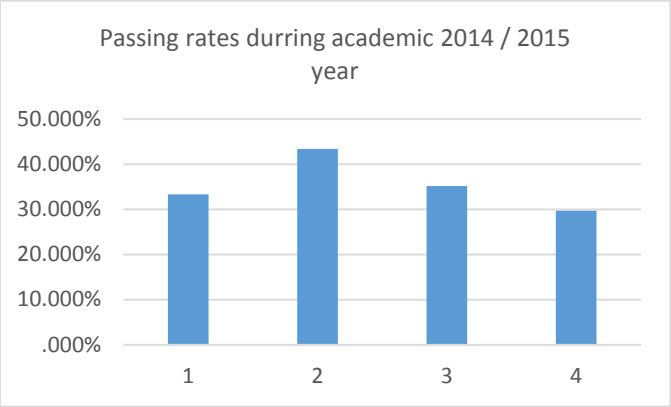

Fig. 5. Passing rates for every exam term in 2014/2015 academic year

When we take this in consideration we can say that the percent of students who passed exam followed expected trend. By analysing the achieved success, we came to the conclusion that organizing the second partial exam in controlled conditions resulted in better grades overall.

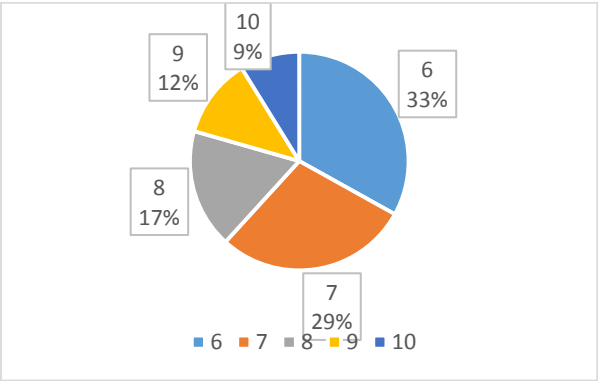

Fig. 6. Grades distribution for 2014/2015 academic year

We can see decreased number of students that had lower grades and increased number of students with higher grades (7,8 and 9). If we compare this to success in exam on the course Communication Technologies, we can see that success is not as good but still follows the positive trend.

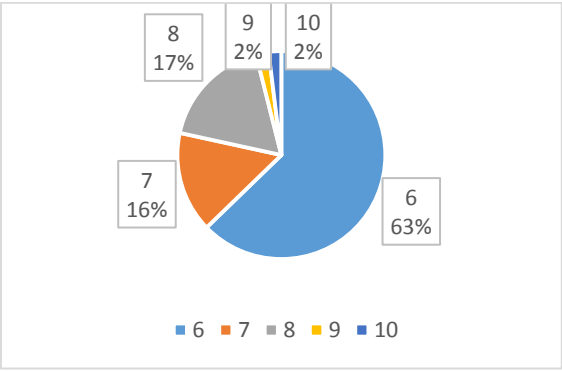

Fig. 7. Grades distribution for 2013/2014 academic year for communication technologies course

These results are related to the fact that student transfer higher level of knowledge from the course Computer Networks to the course Communication Technologies.

Computer networks – current Curriculum 2014/2015

In this academic year, number of students increased compared to previous years. There were 300 students who enrolled for the first time on the course Computer Networks and additional 78 students who decided to study in accordance with the new curriculum (students who enrolled in the next studying year but did not manage to pass this exam, or students who failed to enrol in the next studying year). Percent of students who passed the exam is shown on the chart below.

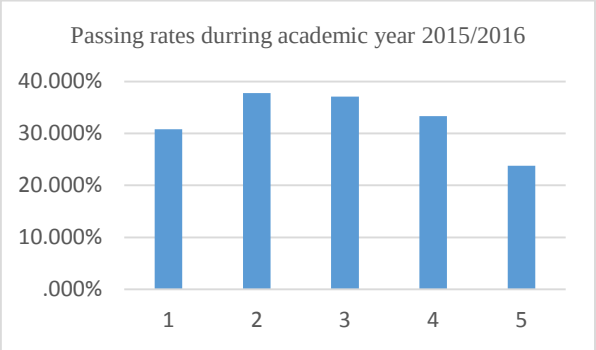

Fig. 8. Passing rates for every exam term in 2013/2014 academic year

Chart shows that both curricula resulted in similar percent of students who passed the exam, but different approach in presenting the course content resulted in different grades distribution.

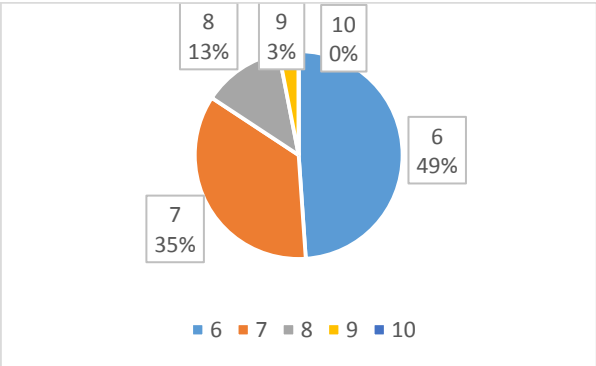

Fig. 9. Grades distribution for 2014/2015 academic year

The number of students who managed to fulfil minimum requirements for passing this exam increased and that is due to the increased number of enrolled students. However, the number of students with the highest grades decreased. These results are also influenced by a certain number of students (20,63%) who took the course in accordance with the old curriculum and later decided to retake the course in accordance with the new curriculum.

Computer Networks – previous Curriculum 2015/2016

Total number of students in this academic year was 13. Total number of students was small since these were the students who enrolled in the next studying year but did not manage to pass this exam.

Accordingly, only four students took the exam in the last term and two of them passed it, which makes 50% of students who passed the exam but this does not reflect any kind of excellence.

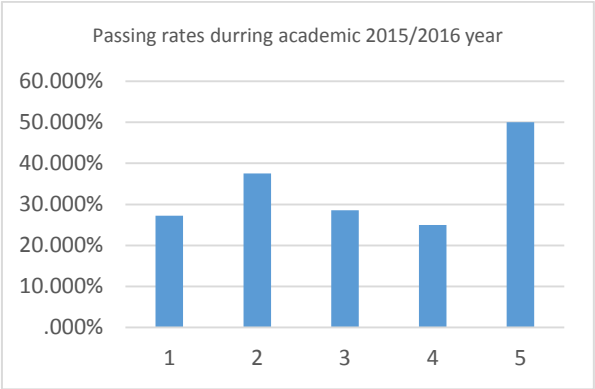

Fig. 10. Passing rates for exam terms in 2015/2016 academic year

Students who do not manage to pass this exam in the next academic year will take the course in accordance with the new curriculum.

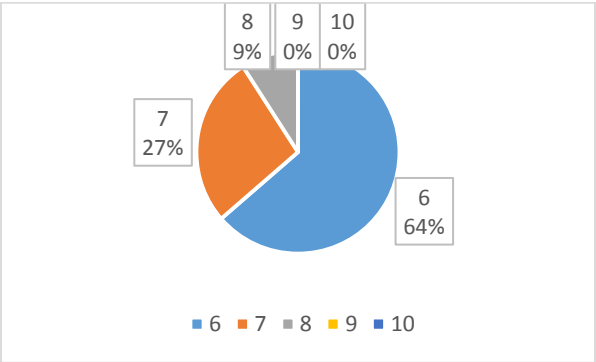

Fig. 11. Grades distribution for 2015/2016 academic year

Certain number of students managed to get good grades in this exam. If we are talking about the course Communication Technologies in this academic year, then success is related only to students who passed the exam for the course Computer Networks based on the previous curriculum and that was 106 students.

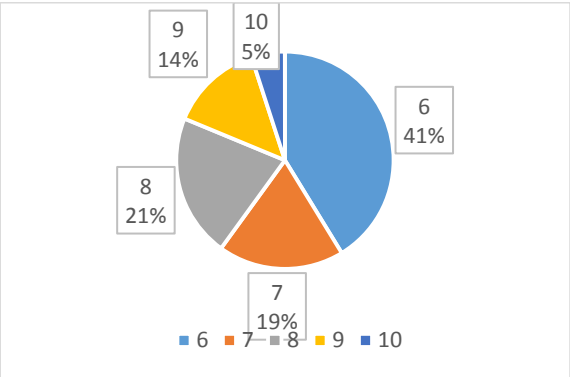

Fig. 12. Grades distribution for 2015/2016 academic year for communication technologies course

Good practice of having the first partial exam in controlled conditions was transferred from the course Computer networks to the course Communication Technologies. As we expected, this also resulted in better success and higher grades.

Computer Networks – current Curriculum 2015/2016

Difference in percent of students who passed the exam in 2014/2015 and 2015/2016 academic year can be related to the fact that the percent of students that had to retake the course was smaller and those were the students who studied in line with the same curriculum throughout the first cycle of studies.

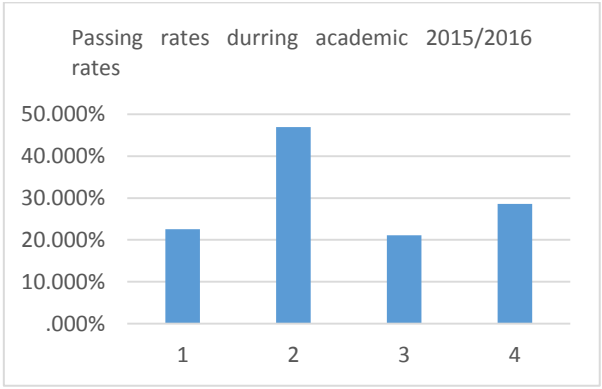

Fig. 13. Passing rates for exam terms in 2015/2016 academic year

We can see that the percent of students passing the exam is still the highest on the first partial exam, but the percent of students who passed the exam on the second exam term was the same as the last year. Overall percent of students who successfully passed the exam slightly decreased (87,40%) but grades distribution changed significantly as we can see on the chart below.

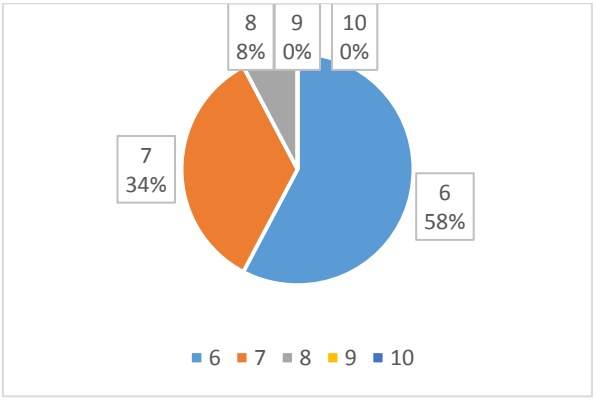

Fig. 14. Grades distribution for 2015/2016 academic year

We can see that the highest grades 10 and 9 are not shown on the chart and percent of grade 8 decreased. Average grade in this academic year was 6,38. The same trend was detected for the course Communication Technologies, as we can see on the following chart.

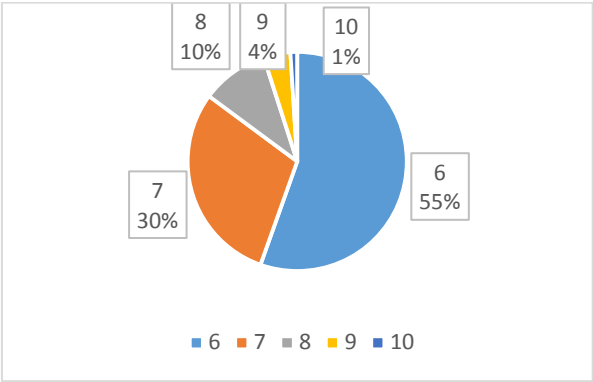

Fig. 15. Grades distribution for 2015/2016 academic year for communication technologies course

Certain number of students passed Computer Networks exam based on the previous curriculum which influenced distribution of grades.

III. CONCLUSION

Research results showed positive effects of having the first partial exam in controlled conditions and extending validity period of the passed exam until the end of the academic year. Decreased number of classes where students could gain practical skills resulted in significantly lower level of knowledge that students acquired. Number of students who managed to reach minimum level of knowledge needed to pass the exam increased and the number of students with high grades was lower. Research confirmed that the curriculum structure and the sequence of courses have direct impact on the level of knowledge acquired and that students are not able to simultaneously acquire knowledge on two courses (Computer Architecture and Discrete Mathematics) and actively use it in the third course (Computer Networks).

Current curriculum was developed with the focus on the competences in the field of software engineering. This curriculum is not suitable for proper gaining of competences in the field of communication technologies. This research should be the starting point for curricula revision that should provide basic knowledge in IT areas on the first year of studies and then on the following years offer at least two groups of courses depending on desired competences. Further development / modification of curricula should follow guidelines of a recognized framework, taking in consideration some specific aspects of a host country[7, 8]. Further research should follow success on the course Communication Technologies in order to confirm or deny the research results and conclusions

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ENTREPRENEURSHIP IN MATH AND VICE VERSA

UDC 005.511:373.3.016

Original research

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Abstract: Entrepreneurship in elementary school is a novelty in Serbian educational system. The paper discusses its validity and importance, and presents its basic principles and methodology. Particular examples concerning some abstract mathematical notions are considered.

I. INTRODUCTION

Entrepreneurship is on a list of European Reference Framework of Key Competences for Lifelong Learning along with basic mathematical and IT skills [4].

The entrepreneurship develops skills in entrepreneur/business from early age at elementary school through projects that require team work, correlation of different programs (subjects), taking both team and personal responsibility for its success (or failure). It is of interest to understand the entrepreneurship as a state of mind, a process of coming up with an idea (not necessarily original) and developing it in a different, original, innovative way. The entrepreneurship supports working on as a team, taking time to develop idea, to implement it, to make it work, to present it…

The paper recalls basic notions of entrepreneurship and presents implementation of an entrepreneurship project in Elementary school "Vasa Stajic", Novi Sad. The coordinator of the project is Filip Kokeza, the school psychologist.

II. ENTREPRENEURSHIP

Information technologies and the development of education entrepreneurship is focused on starting, organizing and innovating the business of the company, with the basic aim of creating a new market and making profits [1].

Entrepreneurs are people who look ahead and see a business opportunity where no one else does. The entrepreneurship idea can be result of thinking and perceiving the economic conditions and needs of a society, an environment or individuals.

It is estimated that 3-5% of people in the world have a talent for entrepreneurship, regardless of their education. But learning and developing functional knowledge is a prerequisite for the development of entrepreneurial skills, regardless of whether the talent exists [2].

Key words of the entrepreneurship are initiative, adaptation, recognition, readiness, motivation, setup changes, benefits, opportunities, projects, real goals…

School is expected to act as a centre for promoting entrepreneurial spirit within the following items:

- learning process in the classroom
- everyday life at school
- in the local community
- in professional development of employees
- motivating employees and supporting entrepreneurial ideas
- through material support
- forming a team for project teaching and entrepreneurship
- in cooperation with the local community
- the realization of projects at school level ...
- cooperation with other schools and exchange of experiences
- supporting student initiatives
- involving school and students in community projects
- launching activities requiring volunteer and humanitarian work
- opening student co-operatives
- rewarding students.

School is not expected to be converted into an enterprise or to commercialize its business and culture.

The role of a teacher in developing entrepreneurship is to:

- motivate and organize the students
- to be ready to learn and to improve
- to create a stimulating environment
- to use project and active teaching
- to have knowledge and skills for planning lessons and teaching.

Most importantly, the teacher permanently has students' well-being on his/her mind! A teacher should:

- have a positive attitude towards entrepreneurship
- possess the knowledge and skills for teaching lessons, integrating entrepreneurship in a way that does not disturb the realization of basic goals and tasks
- encourage and direct students towards the practical application of entrepreneurial knowledge, skills and attitudes in their everyday life
- recognize its role in the development of entrepreneurial knowledge, skills and students' attitudes.

Enterprise as the first step of entrepreneurship is developed through the following: responsibility and patience, communication skills, cooperation and trust, flexibility and tolerance, initiative and reliability, productivity and economic logic, leadership ... Enterprise at students is developed by their personal experience through:

- linking knowledge and experience with their interconnectivity
- developing work habits
- thinking about economic aspects
- introduction of problem situations
- development of critical thinking
- development of cooperation ...

It is not easy to select students capable to comprehensive commitment within the project. Some of helpful indicators for recognizing entrepreneurship students are:

- ready to participate in independent and team projects (of a school, local community ...)
- capable to identify steps in problem solving and make decisions
- motivated to propose and accept other ideas
- motivated to participate in the realization of ideas and their presentation
- ready to participate in humanitarian actions
- respects and treats public goods with responsibility.

Main advantages of the entrepreneurship in elementary school can be emphasized:

- the possibility to achieve educational goals through project teaching and entrepreneurship
- the ability to make a closer connection between teaching and life
- the ability to bring children into economic and financial literacy
- the opportunity for children to learn and gain experience in real- life situations.

Successful world entrepreneur William E. Heinecke, the owner of Pizza Hut restaurant chain, points out that a successful entrepreneur should have the following characteristics: he needs to know how to motivate, to know how to listen, to trust in his team, to say thank you, to be decent, to listen carefully, to be flexible, to remain calm under pressure, to be an example to others, to be an expert in his field, to be modest, to have sense of humor, to know how to celebrate success, to nurture business and social contacts, because no one can be successful if he is alone [3].

III. IMPLEMENTATION OF AN ENTREPRENEURSHIP PROJECT

The project of developing entrepreneurship through interconnection of math, biology and art is in progress. The project team consists of 10 students from the fifth grade, 10 students from the sixth grade and 10 students from the seventh grade, and teachers in the following subjects: mathematics, biology, art, physics, technical and computer subjects. The project is supported by Ministry of Education, Science and Technological Development and the Univerexport foundation , and it started at January 2018 and lasts until June 2018. The project details are discussed in the following, by the grade.

A. Fifth grade

On this stage, the entrepreneurship is developed through growing a small organic garden in pots in a hallway. The students research the idea of growing an organic garden. They work in teams. Topics to be covered are the benefits of growing the organic garden, types of organic gardens – urban and regular and sorts of plants (vegetables, fruit, spices, flowers..) that are typical for this region (in our case, Vojvodina). They should make their first SWOT analysis about growing a small urban garden for example in our school.

After discussing all topics a teacher puts it in a mathematical frame by giving them tasks:

- to color one half, two thirds… of an apple, a load of potatoes, peaches…
- to calculate how many bags of humus is required for pots in which their plants are to be grown.

Mind maps can be a useful tool in technological education that stimulates creative thinking of students, activates the absorption of new concepts and generate ideas. It is important to assess knowledge at the beginning of a topic and after to monitor your students understanding.

Figure 1. A task formulation, fifth grade

- to calculate how many bags of seeds they need for a pot using the given instructions about certain sort of plant
- take measures of the future urban garden in the school backyard

- to calculate the area of it and its circumference (discuss if a fence is required or not)

An example of a task is shown in Fig. 1. Some scenes from the realization of the project can be seen in Fig.2, Fig.3 and Fig.4.

Figure 2. Sowing seeds

Figure 3. The plants have started to grow

Figure 4. Wall art

B. Sixth grade

The entrepreneurship develops through building and redecorating.

Being very attractive the idea of building houses, apartment blocks or just redecorating them can be presented to the six-grade students in a part where they study about the areas of triangles and quadrilaterals. They make their own teams and decide which project is more attractive to them. They make their analysis of good and bad sides and present it to the rest of the class. They can make a wooden/paper model of a classroom or even the whole school (or a school building from their dreams). They should measure lengths and heights, calculate the ratio, calculate how much color they would need to paint the walls, bricks to build them, tiles for the floors. One team can make a paper of what is needed to redecorate one classroom from top to floor, with all necessities - the number of tiles they have chosen, cans of color for the walls, new pieces of furniture and their prices to match the school budget. If their parents agree the students can even do some of the work themselves. This way they can create the environment they like (even put some of the pots from the organic garden).

C. Seventh grade

Their project can be to research fractals in nature and art. All teams can make their Power Point presentations about fractals in nature. It can even be presented to the fifth graders as many vegetables (cauliflower, agave, cabbage…) are fractal- like. They can also research about the computer artists who “paint” fractal pictures and make a living out of it. Mathematical frame can be making a fractal tree in cooperation with a teacher of technical subjects. It means they have to construct branches from right-

angled triangles and rectangles, making them smaller and smaller by calculated ratio. It can be a great practice of team spirit and patience. (Fig.5,6,7).

Figure 5. Students' works / fractals in the nature and in math

Figure 6. Preparations for constructing a fractal tree

Figure 7. The fractal tree

D. Finalization

Collaboration of entrepreneurship and mathematics continues as a project of 8th-grade students in statistics (researching, gathering data, processing it, presenting it (tables, charts, pies, bars), analyzing it, sharing and giving tasks to the lower-grade students). The incentive is given to students to acquire knowledge in the use of the Internet and Microsoft Office Word, Excel, PP.

IV. CONCLUSION

As seen in the photos above there is a small garden decorating our hallway with some vegetables growing. There is also a wall exhibition of students' works as well as a fractal tree that awaits to be finished. Our students took great interest and part in making this project work and get it completed. Taking an action in making ideas into projects and taking responsibility for each step in its realization is what we expect from our students. We intend to continue with this project as new school year starts.

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PROFESSIONAL DEVELOPMENT OF TEACHERS

UDC 371.13

Original research

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Abstract: Despite the enormous development of science and technology teachers remains the main factor in the implementation of education quality. No matter how much a change in education is grounded and theoretically developed, it can't even handle the practice without teachers who understand the changes, accept them and they are trained to apply them. Therefore, following pages are intended to show importance of pedagogical public to the importance of professional development of teachers for achieving quality results in education. Professional development of teachers is long-term process where during learning, practical work and research activities complement the knowledge and develop skills and abilities. Professional development of teachers is open, dynamic and durable process that implies the transferring of new knowledge from various professional areas and scientific disciplines in the world of practice, as well as tracking European trends as regards of improving the quality of education.

I. INTRODUCTION

Professional development of teachers is long-term integrative process where through learning, practical work and research activities develop and improve the knowledge, skills and abilities of individual. Going through this process the teacher became practitioner who scrutinize and in accordance with their needs and the needs of the school sets goals of his own professional development. Professional development of teachers basically is the process of improving skills and competencies in order to improve the quality of teaching, as well as learning and achievements of the students [1]. Preconditions for the continuing professional development of teachers are:

- An education system that enables and supports professional development
- Personal and professional autonomy
- Detection creativity and initiative in implementation of change
- Teaching focused on every single student
- Teamwork during planning, preparing, realization and analysis of the teaching process
- Cooperation with parents and the local community
- Continuous assessment and self-assessment of own work
- Advancement in the profession which is stimulated in different ways. [11]
- Professional development is the result of interaction of training and experience, and includes:
- Formal experience (basic education, seminars, mentoring, workshops, professional gathering)
- Informal experience (tracking professional literature, internet, shows dedicated to educational questions)
- Self-evolution and research educational practices.

II. WHY PROFESSIONAL DEVELOPMENT IS IMPORTANT?

Professional development of teachers enables continuous acquiring, expand and deepen knowledge, developing skills and abilities that are relevant for teaching and extracurricular activities success of students. Also, provides the opportunity acquiring the knowledge and skills that ensure quality and successful collaboration with colleagues and school administration, as well as a quality relationship with parents and local community.[2] It also allows preparing for the acceptance of system change, their successful usage and active participation and initiative in implementing the reform [3].

Collecting and consideration of information on opportunities of professional development at the national level: information about the professional literature, information on seminars and about the other activities of professional development where teachers can participate, information about accredited programs of professional specialization of teachers, connecting schools, exchanging experiences with another schools. Support for teachers at the request or on the basis of observations at school may include: advice and mentoring to the teacher who is probationer, advice of different types of professional self-development, advice to teachers who are preparing to compete for more vocations, advice to teachers who have difficulties in their own work [4].

Interest groups can be formed based on different areas for which there is an interest. For example: interactive methods in teaching certain subjects, the development of instruments for formative grading etc. Interest group may include more persons working together. The results of the activities of these groups can be: materials for teaching and learning, new teaching techniques and methods, sample classes, correlation, etc. [5]

Teachers from other schools can be invited to the meetings which are organized in school, as roundtables, debates, panel discussions, poster presentations, etc. These meetings are discussed about the topics important for school. Curricular approaches and specific activities in the classroom can be integral part of these activities.

Seminars in school can teach only teachers who are certified as trainers, or those who participated in the training for trainers, also as trainers outside of school. Topics may be related to individual subjects or can be a general type and intended for all teachers. If the trainings are related to subject, the training can be organized for the teachers who teach the same subject from several neighbor schools. The training that refers to areas such as: the organization of work in the classrooms, modern methods of teaching and learning, the development of critical thinking through subjects, correlation and integration of subjects, cross-curricular themes, etc. It’s very effective for all teachers who attend.

Organization of open classes can be organized at the level of the subject and classroom instruction, as well as within the one profession. It’s recommended that these classes are performed on a topic that might be interesting for all teachers, or for most of them. These are: interactive methods in classroom, formative grading, individual support to students, usage of ICT in teaching, etc.

Action research can be dealing with various topics. Researching groups is forming and their work is coordinated by the teacher who has high education degree, pedagogue or psychologist at school. Individual development and success of students can be one of the topics for research.

Extracurricular activities are also important because they can have a special role in the development of students’ knowledge and competencies. This area also needs to be planned well and all activities should be part of a long-term vision and development plan.

Mentoring to the teacher who is probationer is a process in which teachers gives support to the student or to the new teacher to make sure to bring them into the practice and to contribute gaining specific experience for successful finishing of studies, or purposeful and successfully completed internship. Mentoring process gives opportunity for professional development as to mentor, also to mentored one.

Supporting of individual learning is the process during which individual with the support of colleagues develops and improves its performance. Colleague as a mediator in the process of thinking and decision-making doesn’t express valuable judgment’s, but supports individual in finding their own solutions.[6]

The skills that are important for the one who supports individual learning of the colleague are: active listening, making questions, giving feedback information and building good relationships. Teachers have access to more and more different resources for professional development, especially thanks to the internet.

III. PRINCIPLES OF SUCCESSFUL PROFESSIONAL DEVELOPMENT RELATED TO IMPROVING SCHOOL

A. Individuals can hardly make a progress in a static school.

In a school that doesn't support professional development, not giving opportunities for practical work and research activities can hardly come to improving of work of teacher and their progress. If teachers want to be successful and to make a progress in acquiring new knowledge, it's necessary that they are offering different possibilities of professional development.

Different levels of development can consist those opportunities for those who are external, such as seminars, courses, conferences and also those that occur in the school such as workshop, research, professional articles , manuals, analysis, statements, demonstration classes, etc. School must be the one that with its teaching staff can enable all these levels for successful professional development.

B. Schools can not be changed without changing what do teachers

What makes a school? Foundations of a school are teachers. And if school wants to make a change, if there's need for making a progress, the teachers must be changed, they should improve their knowledge and they must work on their specialization and promotion over and over again. [7] Therefore there is a change of school. Professional development of school starts teaching staff that provides not only a sense of belonging to the appropriate community of education, but also a common vision in terms of improvements that will be necessary in the future.

C. If teachers make a professional progress only individually, then they probably will not be able to change their school.

One of the teacher's goals is to develop a team spirit in the school in which achievements of every individual became part of the general process of professional development. In comparison with the training that is happening outside of school and mostly represent individual events that happen from time to time in the career of a teacher, professional development at the school level present a continuous process that includes activities such as mentoring, reflective practice, self-improvement, self-monitoring and self-evaluation, individual and group of scrutinize of their own experiences, etc. Happening in school and having a direct influence on her, this kind of professional development can affect the increase in the quality of teaching and learning, but also to the successful work of the school as a whole. Professional development on the school level – in contrast to the trainings that occurs individually, outside of school – move teaching stuff making not only a sense of belonging to corresponding community of education, but also a common vision in terms of improvements that will be necessary in the future.[8] One of the goals of development of PRNŠ is to develop a team spirit in the school where achievements of every individual became part of the general process of professional development.

Sometimes when schools are changing, teachers are not changing along with schools.

In the context of constant change, both in education, and in other spheres of society, roles of teachers are changing, because they require certain knowledge and skills, which is one of the most important reasons for intensive involvement in professional development activities. Professional development at school takes places through horizontal learning (teachers learn from each other) and includes different forms of organized and planned transferring of knowledge or exchange of professional experiences within the school or between schools. A research of the practice shows that the best results, as far as professional development are achieved by using different types of horizontal learning. Teamwork is very important for the realization of horizontal learning. This way of working gets better realization of the professional development of employees at the institution, by condition that it's occurring under principles that make mutual compliance and productivity.[6] Teamwork gives the possibility to create and develop new ideas,

as well as much higher efficiency compared to the work of an individual. And most productive individual needs much more time than a concerted team harmonized team.

D. The learning organization consists of individuals who parallel with performing their basic duties have the opportunity to learn.

Teachers need to have a personal plan of professional development that belongs to the development part of professional portfolio. Making of this plan involves, among other things, identifying those segments of work that individual is performing well, also those roles and aspects of the work which he would like to improve.[9] When we talk about personal plan of professional development, we mean the creation of documents that help employees and school management to improve educational work in a systematic way. Personal plan of professional development should be based on analysis of their own professional needs, also like in the analysis of school needs. The teacher talks about his plan of professional development with the coordinator for professional development, or with some of the team members for professional development.

E. Professional development of teachers is a continuous process that begins with first, and it ends with the last day of their professional practice.

It's a lifelong learning. Professional development is a long-term process that is happening most of the time in the school. Compared with the training that is happening outside of school and is happening periodically, professional developments at the school level represent a continuous process that involves various activities that take place in school. Adoption of new information and successfully dealing with new situations is of central importance for lifelong learning. Assessment of successful work is a process that allows the teacher to assessment its skills, experiences, responsibilities, duties and success in work and to identify ways in which indicated can be improved and all this assessment together with the director. The result of the assessment will be formulating priorities and develop an action plan for the future. The process is interactive, participative and formative i.e. results of the assessment will be basis for work improvement. The teacher is actively involved in all stages of the process. The principles of supporting individual learning are: commitment of giving support to the individual, relationship built on truth, openness and trust, the one who learn by himself is responsible for its results, the one who learn can always achieve more, the focus is on the one who learn thinks what his experiences are, the one who learn can reach the best solutions alone, with adequate support.[10]Mind maps can be a useful tool in technological education that stimulates creative thinking of students, activates the absorption of new concepts and generate ideas. It is important to assess knowledge at the beginning of a topic and after to monitor your students understanding.

IV. CONCLUSION

Many researches have shown that achievement of students is positively associated with the quality of teachers and that a professional development of the teachers has a serious impact of the education quality which receives young people all around the world. In this sense we came to conclusion that a quality education can be reached only by raising the quality of people and professions that are engaged in it.

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COMPARATIVE ANALYSIS OF IT SUBJECTS' TEACHING QUALITY IN HIGHSCHOOLS

UDC 004:373.5.016

Original research

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Abstract: Paper presents the research which authors conducted in the school year 2016/17. The research sample included 1504 pupils from 10 different educational profiles: 4 in high schools (natural mathematics, informatics, mathematics, computer science) and 6 in secondary vocational schools from which 4 were electrical professions (computer technician, multimedia engineer, computer network administrator and electrical engineer of information technology) and 2 mechanical professions (machine technician for computer engineering and computer control technician). Results have shown that there was significant difference between profiles in teaching quality of IT subjects. Future work is related to analysis of current IT knowledge in high schools.

I. INTRODUCTION

Contemporary education in Serbia directs its users to get grades and finish the class in the most efficient way. Later on, they attempt to find a job as quickly as possible and try to solve the problem of existence. It is necessary for education system to be reformed once and for all so that users develop critical opinions, interests and creative abilities, and to be motivated to continue their education.

In Lisbon in 2000, the European Union adopted the Lisbon Development Strategy [1]. As knowledge is one of the basic resources of progress and development, education has become one of the central themes of the Lisbon Strategy, so the Lisbon Strategy implies greater investment in education and professional development, scientific and technological research and innovation [2].

In 2006, the European Union defined eight key competences of the Lifelong Learning Concept [3]. Today they are widely accepted in most European countries and play an important role in educational reforms. The need for improving the quality and importance of skills and competences is further emphasized by the current situation in which Europe faces a high unemployment rate, which is often due to skills mismatch [4].

Digital competencies, as one of those 8 key competences, include managing basic IT skills:

- Safe and critical use of electronic media at work, in leisure and communication;
- Connection with logical and critical thinking, high level of information management skills and well-developed communication skills and
- At the lowest level, the use of multimedia technology for finding, receiving, storing, producing, presenting and sharing information and communication and use in the Internet.

In Serbia, over the past fifteen years, the reform of primary and secondary education has been implemented separately from the reform of higher education. The reform of primary and secondary education is carried out more centrally, while higher education reform is implemented by the higher education institutions themselves. The Government of the Republic of Serbia adopted in 2012 the Strategy for the Development of Education in Serbia until 2020 [5]. The strategy is defined so that the

education system should provide the basic foundation of life and development of each individual, society and state based on knowledge. The Action Plan for the implementation of the Strategy for the Development of Education in Serbia by 2020 specifies individual actions and as one of the key parts of this plan is the Strategy for the Development of Primary and Secondary Education.

It's long ago that the literate man is just the one who uses the computer and runs the computer. It is therefore essential that students at the end of elementary education be informally/digitally literate. It is also essential that students acquire appropriate knowledge at the end of secondary education which will enable them to independently learn and use new technologies in accordance with their evolution during the whole working life. Bearing in mind the continuation of technological development and the potential lack of qualified IT experts, the lack of adequate access to their education can have very adverse consequences.

Information technology is being taught in all analyzed secondary schools, through one or more subjects, and it should provide knowledge to students in three dimensions - on the conceptual plan and acquired skills. Depending on the educational profile, there is more or less IT content in appropriate subjects, with more or less practice.

There are many related researches about analyzing quality of teaching [6, 7, 8], but few of them analyzed IT subjects and comparative analysis of pupils.

In this paper, the evaluation of high school' pupils and secondary vocational schools has done in order to analyze difference between profiles in teaching quality of IT subjects, which is goal of research..

II. METHODOLOGY

Research was done in in the school year 2016/17. The research sample included 1504 pupils from 10 different educational profiles: 4 in high schools (natural mathematics, informatics, mathematics, computer science) and 6 in secondary vocational schools from which 4 were electrical professions (computer technician, multimedia engineer, computer network administrator and electrical engineer of information technology) and 2 mechanical professions (machine technician for computer engineering and computer control technician).

For the purpose of this particular research authors chosen to analyse and compare teaching quality in IT subjects in several highschools in Serbia. Following types of highschools were analyzed:

1 - Electrotechnical school;

2 - Electrical-traffic technical school

3 - Highschool

4 - Machine traffic school

5 - Mechanical-electrical engineering

6 - Mechanical-technical school

7 - Technical school

8 - ITHS (Highschool for IT)

Hypothesis of this research was defined in the following manner: "Pupils in different types of highschools have different teaching quality from IT subjects."

Research tasks were set in the following order:

1. Choosing a sample;
2. Creating a questionnaire;
3. Conducting the research and
4. Analyzing the results.

III. RESULTS AND DISCUSSION

In order to get results about characteristics of different groups one factor of variance analysis was performed (ANOVA).

Table 1 shows data about every group (every school). The table shows number of participants in every school, mean, standard deviation, standard error, confidence interval for mean and min, max.

Table 1. Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
1	527	3.83	1.083	.047	3.73	3.92	1	5
2	46	3.91	1.132	.167	3.58	4.25	1	5
3	399	3.95	1.097	.055	3.84	4.06	1	5
4	34	3.94	1.071	.184	3.57	4.32	1	5
5	72	3.72	1.213	.143	3.44	4.01	1	5
6	84	3.96	1.124	.123	3.72	4.21	1	5
7	576	3.93	1.120	.047	3.84	4.02	1	5
8	56	4.41	0.565	.075	4.26	4.56	3	5
Total	**1794**	**3.91**	**1.098**	**.026**	**3.86**	**3.96**	**1**	**5**

Table 2 gives sum of squares, number of degrees of freedom… The column Sig. is the most significant. In the research Sig. is less than 0,05 which means that there is significant difference between groups.

Table 2. Anova

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21.261	7	3.037	2.535	.013
Within Groups	2139.647	1786	1.198		
Total	**2160.908**	**1793**			

Table 3 present test of homogeneity of variance and for Levenue test Sig. is higher than 0.05, so the the assumption about the homogeneity of variance has not been violated.

Table 3. Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
1.985	7	1786	.054

Table 4 present exact difference between group. According to Table 4 there are significant difference between these groups: 1 and 8; 5 and 8; 1 and 7; 7 and 8.

Table 4. Multiple comparisons

Dependent Variable: Odgovor
Tukey HSD

(I) Skola	(J) Skola	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-.086	.168	1.000	-.60	.42
	3	-.123	.073	.696	-.34	.10
	4	-.114	.194	.999	-.70	.47
	5	.105	.138	.995	-.31	.52
	6	-.137	.129	.964	-.53	.25
	7	-.100	.066	.801	-.30	.10
	8	-.583*	.154	.004	-1.05	-.12
2	1	.086	.168	1.000	-.42	.60
	3	-.037	.170	1.000	-.55	.48
	4	-.028	.248	1.000	-.78	.72
	5	.191	.207	.984	-.44	.82
	6	-.051	.201	1.000	-.66	.56

	7	-.014	.168	1.000	-.52	.49
	8	-.498	.218	.302	-1.16	.16
3	1	.123	.073	.696	-.10	.34
	2	.037	.170	1.000	-.48	.55
	4	.009	.196	1.000	-.58	.60
	5	.228	.140	.736	-.20	.65
	6	-.014	.131	1.000	-.41	.38
	7	.023	.071	1.000	-.19	.24
	8	-.461	.156	.064	-.93	.01
4	1	.114	.194	.999	-.47	.70
	2	.028	.248	1.000	-.72	.78
	3	-.009	.196	1.000	-.60	.58
	5	.219	.228	.980	-.47	.91
	6	-.023	.222	1.000	-.70	.65
	7	.014	.193	1.000	-.57	.60
	8	-.470	.238	.500	-1.19	.25
5	1	-.105	.138	.995	-.52	.31
	2	-.191	.207	.984	-.82	.44
	3	-.228	.140	.736	-.65	.20
	4	-.219	.228	.980	-.91	.47
	6	-.242	.176	.868	-.78	.29
	7	-.205	.137	.809	-.62	.21
	8	-.688*	.195	.010	-1.28	-.10
6	1	.137	.129	.964	-.25	.53
	2	.051	.201	1.000	-.56	.66
	3	.014	.131	1.000	-.38	.41
	4	.023	.222	1.000	-.65	.70
	5	.242	.176	.868	-.29	.78
	7	.037	.128	1.000	-.35	.43
	8	-.446	.189	.260	-1.02	.13
7	1	.100	.066	.801	-.10	.30
	2	.014	.168	1.000	-.49	.52
	3	-.023	.071	1.000	-.24	.19
	4	-.014	.193	1.000	-.60	.57
	5	.205	.137	.809	-.21	.62
	6	-.037	.128	1.000	-.43	.35
	8	-.484*	.153	.035	-.95	-.02
8	1	.583*	.154	.004	.12	1.05
	2	.498	.218	.302	-.16	1.16
	3	.461	.156	.064	-.01	.93
	4	.470	.238	.500	-.25	1.19
	5	.688*	.195	.010	.10	1.28
	6	.446	.189	.260	-.13	1.02
	7	.484*	.153	.035	.02	.95

Diagram for means for different groups (schools) is presented in Figure 1. Diagram shows that school 8 has the best rated quality of informatics subjects, while the school 5 has the lowest rates regarding quality of informatics subjects.

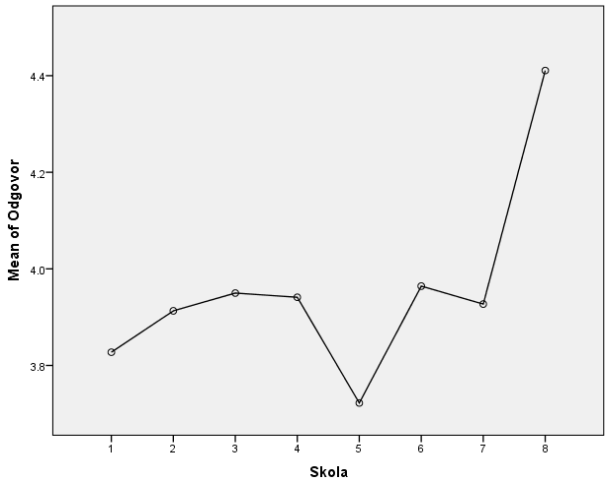

Figure 1. Diagram of means

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IV. CONCLUSION

Bearing in mind the presented results of this research, it can be concluded in different directions:

- About the possibility of applying ANOVA technique in retracing the quality of teaching from a certain group of subjects – IT subjects in the case of this research. The mentioned technique determined a significant statistical difference, as specific groups between which there were differences.
- The study on the quality of teaching gives the opportunity to improve it, especially in schools 1 and 5.

The future work relates to the analysis of the same issue, from the teaching aspect, through the answers obtained from teacher education in the same schools.

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MENTORSHIP IN THE PROCESS OF INTRODUCING THE TEACHER PRENTICE IN THE PRIMARY AND SECONDARY SCHOOLS

UDC 371.213.3

Original research

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Abstract: This paper highlights and explains the importance of mentoring in the process of introducing prentice teachers to work in primary and secondary schools, starting with emphasis on traineeship, and then highlighting the importance for students, the mentors themselves and the entire educational institution. The legal regulation of the process of introduction into the work of teacher prentices in the Republic of Serbia has been described and explained. The competences, the knowledge, skills and abilities necessary for achieving educational work, which the program of introducing into the work of a trainee teacher should acquire, were also described.

I. INTRODUCTION

The word mentor comes from Greek mythology, from the myth of Mentor and Telemach. Namely, before leaving the Trojan War, Odysseus left his son Telemach to a friend Mentor to care for him. Telemah in Mentor, according to Helen Colley (Colley, 2000), gained not only a parent, but also a counselor, teacher, and a leader.

In addition to this, through the centuries there are many well-known mentoring relationships in the meaning of teachers and leaders such as Socrates and Plato, Michelangelo and Lorenzo de Medici, Leonardo da Vinci and Verocio, Karl Jung and Sigmund Freud and many others.

The meanings of the essence and the notion of mentoring as we know today and how much of the educational heritage and the past it presents, are the issues on which there are opposing attitudes even today. However, according to Klaterbak (Klaterbak, 2009), the largest number of theorists agree that the basic concept of mentoring, as we know today, leads to the origin of apprenticeship. This concept was brought down to teaching. "The essence of this teaching was based on the relation of an older and more experienced person who tried to convey his knowledge, skills and attitudes about work and profession to a person younger than himself, yet inexperienced in the business, but willing to study and continue where the mentor (master, employer) stops."(Sijakovic, 2015: 4). The idea of formalizing the existing mentoring concept emerged in the late 1970s in America. "The formalization of mentoring that began at that time has been sustained to a great extent even today, primarily because there is a potential for learning and development that mentoring could provide for newcomers as well as those who already have some experience and practice. In addition, companies and enterprises that have been practicing mentoring as a form of work with (new) employees have made significant profit. Formalization of mentoring, which then begins to gain on importance, implied the emergence of new documents which among other things should be defined who can be a mentor, i.e. how are mentors elected?

Today, a large part of Europe and Australia, the United States, and to a large extent, Canada has a clearly defined and formalized mentoring system. There are clearly defined answers to questions about

who, how and under what conditions becomes a mentor, what kind of programs they are doing; with how many trainees; whether or not the public services follow their work, etc.

According to Carmin (Carmin, 1988), mentoring is a complex, interactive process that takes place between individuals of different levels of experience and expertise, in which an expert mentor gives support to his colleagues in order to become more efficient in his work and contribute to the achievement of the goals of the institution in which he is working. The ultimate goal is professional development and career advancement.

II. LEGISLATION ON THE PROCESS OF INTRODUCING OF TEACHER PRENTICES INTO THE WORK IN THE REPUBLIC OF SERBIA

Legislative and by-laws and manuals regulating prenticeship and mentoring work in Serbia in the field of education are: Law on the Foundations of the System of Education and Upbringing ("Official Gazette of RS", No. 72/2009, 52/2011, 55/2013) , The Rulebook on the Permit for the Work of Teachers, Educators and Professional Associates ("Official Gazette of the Republic of Serbia" 22/05 and 51/2008) and the Mentor and Trainee - A Guide for Teachers, Educators and Professional Associates (Authors Group, 2009). In addition to them, there is also a Guide for the introduction to classroom teaching, a guide for the introduction of teaching work in primary and secondary schools (Group of Authors, 2006), a Guide for the introduction into the work of teachers in pre-school institutions, a guide for introducing the work of educators in students' homes, a guide for introducing librarians into school libraries, and a guide to the introduction of professional associates in educational institutions that are published by the Institute for the Advancement of Education from 2006.

Trainee, in the sense of the Law on the Foundations of the System of Education and Upbringing ("Official Gazette of the Republic of Serbia" No. 72/2009, 52/2011 and 55/2013), is the person who for the first time in this capacity establishes a working relationship with the institution, in definite or indefinite time, with full or part-time work and is being trained for the independent educational work of teachers, educators and professional associates, mastering the program for introduction into the work and taking the exam for the teaching license.

The Rulebook on the Permit for the Work of Teachers, Educators and Professional Associates ("Official Gazette of the Republic of Serbia" No. 22/2005 and 51/2008) regulates: the program of introduction into the work of teachers, educators and professional associates, the manner and procedure of checking if the program was successfully completed, the program for obtaining a work permit, ie, the license, the costs of taking the exam for the license and the administrative body before which the exam for the license is taken, the content and the manner of keeping the register of teachers, educators and professional associates to whom the license and license form is issued.

The goal of introducing the prentice teacher is to enable him for independent educational work and for taking a license exam. Based on the program of introduction to the work, the prentice teacher acquires knowledge and develops the skills and abilities necessary for achieving educational work.

III. TEACHER COMPETENCIES

Based on the Rulebook on the Permit for the Work of Teachers, Educators and Professional Associates, ("Official Gazette of the Republic of Serbia" 22/05 and 51/2008), the internship program should allow teacher, educator, and expert associate to acquire knowledge and develop skills and competences, i.e. competencies necessary for the realization of educational work related to the following areas:

- Planning, programming, achieving and evaluating educational work;
- Monitoring the development and achievement of students;
- Cooperation with colleagues, family and local community;
- Work with students with disabilities;
- Professional development;
- Documentation.

Selected areas cover the entire educational work and each of them has its place and role in order to successfully implement educational practice. At the faculty, certain theoretical knowledge, necessary for work, is acquired but not enough for work in the field of education.

The world of work and practice in the field of education requires the practical application of theoretical knowledge, using different skills and abilities. The introduction program begins with these needs of trainees in order to create the basis for the further development of professional competencies. (Group of authors, 2006).

IV. THE ROLE OF MENTORS IN THE PROCESS OF INTRODUCING PRENTICE TEACHERS INTO WORK

Prerequisites for successful mentoring, from Mentor and trainee - a guide for teachers, educators and professional associates (Group of Authors, 2009) are:

- The mentor knows the profession and teaching,
- The mentor is respected by his colleagues,
- The mentor has the appropriate work ethic.

However, the main goal of mentoring is that the mentor successfully realizes his roles in the process of introducing a prentice into work. Namely, the Law on the Foundations of the System of Education and Upbringing ("Official Gazette of the Republic of Serbia" No. 72/2009, 52/2011, 55/2013), Ordinance on the permission for the work of teachers, educators and professional associates ("Official Gazette of the Republic of Serbia" (Group of Authors, 2006) and Guide for Teachers of Teachers of Subject Teaching in Primary and Secondary Schools (Authors Group, 2006) accurately define the role of mentors in the process of introducing prentice teachers into the work through the same six areas to which the knowledge, skills and abilities that the teacher prentice should acquire are related.

V. RESEARCH IN THE FIELD OF PRENTICESHIP AND MENTORING

There is a lower number of research in the world in the field of introducing prentice teachers into the work that looks at this process both from the viewpoint of the mentor and the prentice. One such more important research is the study of mentoring in schools conducted by Schulman (Schulman, 1985, according to Sijakovic, 2015: 95) and is known as the California Mentoring Program Study. It contains many allegations of concrete interviews with teachers and explores mentorship from a perspective that includes mentors, trainees and school administration. The research showed that mentors played a major role in helping trainees in the following:

- to find the necessary resources in schools;
- to refer them to workshops and training;
- to present them and get acquainted with the collective;
- to help them improve their teaching practice;
- to adapt their knowledge to their style of work.

In addition to this research, Krupova's research (Krupp, 1985, according to Sijakovic, 2015: 95), which opens a new perspective of looking at mentoring with a postulate that this kind of work is useful not only for trainees, but also for mentors who through mentoring experience some kind of professional revival. The results of the Krups are based on a survey conducted with primary and secondary school teachers, applying a questionnaire containing various questions related to the experiences of teachers related to mentoring practice.

The results showed that: out of the total sample survey, 72% of primary and 93% of secondary school teachers had mentors; 56% of primary and 45% of secondary school teachers had experience as mentors themselves, but the most significant results of the Krupa research are those who show that mentors have progressed in terms of increasing self-confidence, personal and professional growth and restoring confidence in the fact that the school and the job they are doing actually make sense.

In our vicinity in Montenegro at the Institute for Education, a research on mentoring was carried out where the data necessary in order to provide support to mentors and to improve the mentoring process were obtained. The way the mentoring process in schools is taking place was examined, as well as the

needs of mentors and beginner teachers. One of the conclusions of the research relating to the mentors and the type of support they need is that teachers as mentors perceive the role of mentors as a special recognition by the administration of the school and the collective. They are proud of being recognized at school as professional, working, responsible and creative individuals, who are expected to convey their knowledge and experience to colleagues who they train for self-employment.

The research, among other things, provided the basis for the creation of a training program and the development of a manual for mentors to the beginner teacher.

There is very little research in the field of education that deals with the problem of apprenticeship and mentoring, and they are mostly theoretical. In the only complex and extensive research in this field, the author came across in the doctoral dissertation of Tanja Sijakovic (Sijakovic, 2015) with the topic "Mentoring in the function of stimulating reflexive practice of teachers".

The aim of the research was to examine the phenomenon of traineeship and mentoring in the context of its understanding by trainees and mentors and the way in which they practice it. In this sense, three research tasks have been defined:

- Examine how mentors and prentices understand the prentice mentoring practice they have implemented;
- Examine how mentors and prentices understand and interpret key points in the law, rulebook and manual, which regulate apprenticeship and mentoring issues;
- Analyze whether the manner of understanding the concept and its application in practice support the development of reflexive practitioners.

The results of the research singled out the empirical typology within which three possible types of mentoring were defined in our country: Ad hoc, Form and Development, and gained insight into the possibilities and potentials of a different approach to professional development of teachers in relation to the existing concept and practice.

Ad hoc mentoring is internally motivated acceptance of mentoring. Mentor gives his best, but on the go, relying solely on one's own practice. The responsibility for success depends on the will and commitment of the prentice.

The “Form” mentoring is externally motivated acceptance of mentoring with predetermined success. No other option is considered because it would involve unnecessary activities and deviation from the usual behavioral patterns.

Developmental mentorship is internally motivated acceptance of mentoring with the insight in the opportunities for one's own growth and development and the sharing of responsibility for what is happening in practice.

VI. OPINIONS OF MENTORS AND PRENTICE TEACHERS ABOUT ACHIEVING MENTOR ROLE

A survey conducted during the month of May and June 2017 in two primary and two secondary schools in Novi Sad is an attempt to contribute to research on this subject, to discover some problems of mentoring and the directions in which it should go in order to find solutions to the problem.

The aim of the research was to compare the opinions of mentors and trainee teachers on the role of mentors in the process of introducing prentice teachers into work and to identify disagreements and differences in thinking, ie to identify the problems of the process from the viewpoint of the mentor and expectations of the prentice.

The data was collected through a survey, where one form was used for the teachers who completed the survey from the perspective of mentors and the other were teachers' questionnaires who filled the survey from the apprenticeship perspective. A total of 50 teachers from the viewpoint of the mentor and 50 teachers from the perspective of the trainee filled out the questionnaires. The results of the survey were

processed using the following statistical methods: descriptive statistics and t-test methods. After the results of the survey were completed, the following auxiliary hypotheses were confirmed:

Hypothesis1: The opinions of mentors and trainee teachers about the role of mentors in the process of introducing trainee teachers into work in the field of planning, programming, exercising and evaluating educational work are different.

Hypothesis2: The opinions of mentors and trainee teachers about the role of mentors in the process of introducing trainee teachers into the work in the field of monitoring the development and achievement of students vary.

Hypothesis3: The opinions of mentors and trainee teachers about the role of mentors in the process of introducing trainee teachers into work in the area of cooperation with colleagues, family and the local community are different.

Hypothesis5: The opinions of mentors and trainee teachers about the role of mentors in the process of introducing trainee teachers into work in the field of professional development are different.

Hypothesis6: The mentors and trainee teachers' perceptions about the role of mentors in the process of introducing trainee teachers into the work in the field of documentation management are different.

The following auxiliary hypotheses have not been confirmed:

Hypothesis4: The opinions of mentors and prentice teachers about the role of mentors in the process of introducing prentice teachers into working with students with disabilities are different.

Hypothesis7: The mentors and prentice teachers' opinions about the role of mentors in the process of introducing prentice teachers to work in primary and secondary schools vary regardless of the length of time period introducing into work took place.

Based on the previous, it was concluded that even the main hypothesis can not be confirmed, if the opinions of the mentors and the prentice teachers on the achievement of the role of mentors in the process of introducing teacher prentices into work in primary and secondary schools are different.

Although the main hypothesis that the opinions of mentors and prentice teachers regarding the role of mentors in the process of introducing prentice teachers to work in primary and secondary schools are not fully proven, data analysis led to the following important conclusions:

Opinions of mentors and trainee teachers about the role of mentors in the process of introducing trainee teachers into the work in the field of planning, programming, achieving and evaluating educational work differ from time to time, regardless of the time during which the process of introducing into the work took place. There is a big difference in opinion about the presence of a mentor at the apprentices' classes and the attitude of trainees who feel that mentors do not point out the ways in which omissions can be overcome, if there are omissions. In addition, the non-compliance with the Rulebook on the permission for the work of teachers, educators and professional associates after its entry into force documents that the mentor must be present at at least 12 classes of trainee teachers and vice versa. The number of these classes is in most cases lower than determined by law. Whether this is an unconscionable performance of mentoring or a failure to comply with legal regulations remains an open question.

The opinions of mentors and trainee teachers about the role of mentors in the process of introducing trainee teachers into the work in the field of monitoring the development and achievement of students vary, regardless of the time in which the process of introducing into the work took place. And there is a worrying claim, that is, trainees believe that the mentor does not give guidance to the trainee how to make grading be motivational, which should be one of the basic grading functions.

The opinions of mentors and teacher trainees on achieving the role of mentors in the process of introducing teachers into the work in the area of cooperation with colleagues, family and the local community differ, regardless of the time during which the process of introducing into the work took place. The biggest problem in this area is that trainees believe that the mentor does not provide

suggestions for problem solving and does not share his experience on cooperation with parents, while mentors even evaluate their engagement with very high grades on this issue.

In the process of introducing trainee teachers into work in the field of working with students with disabilities, there is the greatest agreement in the mentors and trainees' opinions, but in a negative sense. Namely, mentors evaluate their work with low grades as well as trainees. The positive side of this kind of mentor's opinion of his work is the fact that they are aware of their failures.

The attitude of the prentices is also worrying, about the fact that the mentor does not fill out the pedagogical documentation and does not indicate any omissions if there are any, although the mentors, in this case, have a high opinion of their work in the field.

As a solution to the problems that may arise in the mentor's work on the introduction of teacher prentices, the introduction of monitoring of their work and the organization of training for mentors could be put into practice. Namely, mentoring should be built as part of a comprehensive system of professional development, which requires the coordinated action of various institutions and individuals that are relevant to this process. Only in this way can a responsible attitude towards education be created which will then create circumstances suitable for professional development of both mentors and prentices

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