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With this publication, the CD with all papers from the International Conference on Information Technology and Development of Education, ITRO 2017 is also published.

INTRODUCTION

The Technical Faculty "Mihajlo Pupin", Zrenjanin, of the University of Novi Sad, the Republic of Serbia organizes VIIIth International Scientific Professional Conference "Information Technologies and Development of Education 2017" (ITRO 2017). The Conference will be held on 22nd June 2017 at the Technical Faculty "Mihajlo Pupin" in Zrenjanin, Serbia.

The Conference "Information Technologies and Development of Education 2017" (ITRO 2017) is organized due to the needs to connect science, profession and education through topics and content concept, first of all concerning the teaching process as base of information society. The tendencies of developed countries are in accordance with the efforts of UNESCO to improve this area related to the needs of life and work in the XXIst century. It is necessary to assess the state, detect the problems and perspectives of the development of education by competent professionals and teachers as well as the influence of the development of education on the development of the society as a whole.

The central topic of the meeting is the model of dual education as base for creating good base for the development of industry. Thus, our aim is to gather the representative entities who are able constructively contribute to establishing link between the educational system and industry as follows: Chamber of Commerce of Serbia – Centre for Dual Education, Ministry of Education, Science and Technological Development, Union of Employers of Serbia, ZREPOK – Business Organization of Zrenjanin and Companies that run their business in the region, directors of grammar schools and secondary vocational school, members of the academic communities and other participants who are interested in the topics.

The main topics of the scientific professional conference are:

- Model of dual education
- Teaching based on the concept of entrepreneurship

Other thematic areas of the Conference:

- Theoretical and methodological questions of contemporary Pedagogy
- Digital didactics media
- Contemporary communication in teaching
- Curriculum of contemporary teaching
- Developing teaching
- E-learning
- Management in Education
- Teaching methods of natural and technical subjects
- Information-communication technologies

The Chairman of the Organizing Committee of the ITRO 2017 Prof. Dragana Glušac opened the Conference. The participants were addressed by the vice dean of the Technical Faculty »Mihajlo Pupin«, Prof. Dijana Karuović; provincial secretary for science, higher education and scientific Research prof. Zoran Milošević, and the vice-major of Zrenjanin Mr. Dusko Radisic.

There were total of 143 authors that took part at the Conference from 12 countries, 2 continents: 82 from the Republic of Serbia and 61 from foreign countries such as: Macedonia, Bulgaria, Slovakia, Austria, Cyprus, Albania, Hungary, Spain, Bosnia and Herzegovina, USA, Portugal.

The Proceedings of papers contains 60 papers and it has been published in the English language.

President of the Organizing Committee
Prof. dr Dragana Glusac

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Data Mining and Curriculum Development in Higher Education

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Abstract - The paper presents how applying of data mining techniques can improve curriculum development in higher education. Development of good curriculum is crucial for higher education institutions because good curriculum should attract new students, improve the success rate of enrolled students, increase the quality and visibility of institution. The sequence of courses within curriculum can considerably influence on students' success in achieving planned learning outcomes. However, this sequence is sometimes very subjective judgement of teachers. The aim of the paper is to find appropriate curricula structure and course sequence by using data mining techniques, as more objective approach, based on data that higher education institutions already had in their information systems. The authors used real data to research the influence of achieved grades on predictors courses on achieved grades on dependent courses, in order to find if data mining techniques can contribute to the improvement of curriculum.

I. INTRODUCTION

Most universities during their existence have accumulated a large amount of students' data stored in their information systems, i.e. databases. But data itself does not represent any value for these universities if there is no adequate management, finding and extracting of meaningful patterns and transformation of data into useful knowledge. Deploying data mining tools is a mechanism that enables analyzing and management of large volume of data, as well as discovering of new patterns that can be helpful in problem solving and decision making [1].

Data mining is the extraction of implicit, previously unknown, and potentially useful information from data [1]. Data mining methods have become very effective data analysis tools in various application domains, primarily because of their ability to deal with large volumes of structured and unstructured data and their ability to discover relevant and non-trivial information without prior knowledge [2]. It is about solving problems by analyzing data already present in large quantities of data in order to discover meaningful patterns and rules [3].

Generally, data mining tasks can be classified as anomaly detection, association rule learning, clustering, classification, regression, summarization [4]. There are many application areas of data mining like customer analytics, agriculture, banking, security applications, educational data mining, mass surveillance, privacy preserving etc. [4].

According to literature, application of data mining techniques in higher education (called Educational Data Mining) mostly means application of data mining techniques like clustering, classification, visualization and association [5, 6, 7]. Application of data mining in educational systems is focused to the support of the specific needs of each of the participants in the educational process [8].

Data mining is the computational data process based on analyzing data from different perspectives. Its goal is to find and extract implicit and interesting samples [9], trends and information. Data mining can greatly help to the educational stakeholders to improve the understanding of the overall educational process, as well to discover, detect and explain educational phenomenon [10]. For example, the student can have an opportunity to recommend additional activities, teaching materials and tasks that would improve his/her learning. Professors would have the feedback, possibilities to classify students into groups based on their need for guidance and monitoring, to find the most made mistakes, find the effective actions, etc. Administration and administrative staff will receive the parameters that will improve system performance [7].

So far key areas of using data mining techniques in higher education are: mining student's performance and mining enrollment data while key application of data mining techniques in

higher education include predicting student performance and studying learning in order to recommend improvements to current educational practice [11, 4]. More specific, the main domains of data mining implementations in higher education are following [4, 12]:

- Analysis and visualization of data is used to highlight useful information and support decision making. It can help in analyzing the students' course activities and getting a general view of a student's learning [12].
- Predicting student performance helps in predicting student's performance i.e. to predict about his success in a course [12]. Different techniques and models like neural networks, Bayesian networks, rule-based systems, regression, and correlation analysis are applied to analyze educational data.
- Outlier analysis has been used to detect and, where appropriate, remove anomalous observations from data [4].
- Grouping students means creating groups of students [11] according to their customized features, personal characteristics, etc. These clusters/groups of students can be used by the instructor/developer to build a personalized learning system which can promote effective group learning.
- Enrolment management is frequently used in higher education to describe well-planned strategies and tactics to shape the enrolment of an institution [13] and meet established goals. Such practices often include marketing, admission policies, retention programs, and financial aid awarding.
- Management and generation of strategic information is the process of application of the IT i.e. mature strategic information system (SIS). SIS can be applied to facilitate academic and administrative activities in educational institutions. The aim is to put forward a way to understand the students' opinions, satisfactions and discontentment in the each element of the educational process [14].
- Target marketing uses data mining algorithm to generate target set which is used by marketing agent to organize promotion and marketing campaigns. The case study [15, 16] predicts the alumni pledges and helps universities to develop a cost-effective method to identify those alumni most likely to make pledges.

But the possibilities of application of data mining techniques in higher education do not end here. As already stated, the application of data mining techniques in higher education brings benefits to different stakeholders. However, data mining brings the significant benefits in the process of design, implementation and evaluation of curricula.

In the process of the curricula development and implementation, the decisions on what is to be taught, for what reasons and how learning should look like are crucial for success of curricula. The term „curriculum" involves learning objectives, content, processes and organization intended for a subject or study program [17]. Kelly [18] defined 4 major dimensions of curricula:

- The intentions of the planners of the curriculum,
- The adopted procedures following the implementation of the curriculum at classroom level,
- The students' actual experiences with attempts of their teachers to realize the curriculum,
- The student's „hidden" learning that occurs as a by-product responding to the organization of the curriculum and of the school.

European higher education reform, well known as Bologna process, brought shift from teaching to learning and recognized learning outcomes as one of the basic building blocks of Reform. The course, basic unit of curricula, is no longer a limited piece of disciplinary knowledge, but a set of intended learning outcomes. Learning outcomes should not be based on reproduction of factual knowledge, but formulated as competences the learners should be able to demonstrate after completing this course. Curricular contents are then no longer justified by their relevance in a certain scientific discipline, but by their contribution to the development of the intended outcomes [17].

In order to ensure successful achievement of planned learning outcomes, the curricula have to be carefully designed and implemented. The way how the parts of curricula (courses) are designed, their complexity and volume, and especially they sequence within curricula, can considerably influence on students' success in achieving planned learning outcomes. The sequence of courses within curricula is usually the result of correlation between different disciplines, necessity for ensuring comparison with similar curricula on other HEIs, and sometimes very subjective judgement of teachers. Because of this, the authors

raised the question: is it possible to find appropriate curricula structure and course sequence through different, more objective approach by using data that HEIs already had in their information systems, i.e. databases.

Namely, data about students and their activities during the studies is usually used in forecasting of their final success/fail, classification of students and etc. However, the same data can be used in analysis, design, implementation and evaluation of curricula. It is because of the fact that curriculum is one of the variables that influences student's final achievement of learning outcomes and successful/unsuccessful finishing of study program. For example, in situation when the sequence of courses within curriculum is conditioned, student cannot take exam from one course before he/she passed exam from another, prior in the sequence, course. In that case, the achievement of learning outcomes from one course is the precondition for the achievement of learning outcomes and successful passing of another, correlated course. But, if the sequence of courses within curriculum is not well established, students will not on time achieved requested learning outcomes and that can lead to the poor results on other courses.

Accordingly, the aim of the paper is through the research of determination of courses, i.e. through researching the influence of achieved grades on predictors courses on achieved grades on dependent courses, find if data mining techniques can contribute to the improvement of curriculum.

II. DECISION TREES AND CURRICULUM ANALYSIS

Decision trees, also called rule induction techniques, are relatively easy to explain, since the notions of trees, leaves, and splits are generally understood [19]. Inductive reasoning refers to estimation of a sample while the population is known. Decision trees use splits to conduct modeling and produce rule sets. Heuristic based decision trees, also called rule induction techniques, include classification and regression trees.

Decision trees have a very wide application in all aspects of human activity. They can be applied in technical, organizational and social sciences. Decision trees are especially useful when in cases of huge amounts of data is necessary to reach some conclusions, i.e. make decisions based on conclusions derived from decision tree.

A. Data set

Defined goal requires that data processing determines the influence of specific set of predictors' courses (independent variables) on specific course (dependent variable). The set of predictors' courses can consist of one, two or more courses, depending on the research goals. The data set for the presented model includes data about students' academic performance (success and failure) on Faculty of Information Technology, University of "Džemal Bijedić" in Mostar, in the period from 1998 to 2016.

The initial set of data included the following data: student code, gender, year of birth, study mode, year of enrollment, date of enrollment, course code, grade, date of exam. Since the main goal is to research determination of courses, data set was adapted in a way that just data related to the exams' grades were keep. The names of courses were coded as follows: PredmetID = 1, PredmetID = 2, PredmetID = 4. The numbers assigned to courses have no any meaning (they do not represent semesters, years, or studies).

The model PredmetID = 4 (2) was defined and the variables in the model were defined as follows:

- Independent variables (predictors): PredmetID = 1, PredmetID = 2,
- Dependent variable: PredmetID = 4.

In total 1620 students was registered for course PredmetID = 4 whereof 763 passed exam, 858 failed and 19 students did not approach to exam. Table 1 shows distribution of students according grades. R language was used as a tool for analysis. Dependent variable was expressed as a nominal variable with the following values: A= grade 10, B= grade 9, C= grade 8, D= grade 7, E= grade 6, F= grade 5, X= not approach to exam.

TABLE I. DISTRIBUTION OF STUDENTS ACCORDING GRADES

Grade	***10 (A)***	***9 (B)***	***8 (C)***	***7 (D)***	***6 (E)***	***Σ***
Number of students	57	93	119	187	307	763

B. Results

The description (training) of the decision tree training is shown below.

```
Fitted party:
[1] root
| [2] ocj_pred_2 <= 5
| | [3] ocj_pred_2 <= 0: X (n = 8, err = 12.5000%)
| | [4] ocj_pred_2 > 0
| | | [5] ocj_pred_1 <= 5: F (n = 367, err = 1.6349%)
| | | [6] ocj_pred_1 > 5: F (n = 133, err = 12.0301%)
| [7] ocj_pred_2 > 5
| | [8] ocj_pred_1 <= 5: F (n = 32, err = 37.5000%)
```

| | [9] ocj_pred_1 > 5
| | | [10] ocj_pred_1 <= 8
| | | | [11] ocj_pred_1 <= 7: E (n = 396, err = 64.1414%)
| | | | [12] ocj_pred_1 > 7: D (n = 165, err = 73.3333%)
| | | [13] ocj_pred_1 > 8: B (n = 69, err = 73.9130%)
Number of inner nodes: 6
Number of terminal nodes: 7

The decision tree consists of 6 nodes and 7 leafs (terminal nodes). The percentages of error probability were calculated for the each outcome (1-p). The leaf with the smallest error (the greatest probability of achievement) is the leaf 5 where the error is 1.63% (the percentage of probability for outcome F is 98.36%). The leaf with the highest error (the smallest percentage of probability for fulfillment) is leaf 13 where for the outcome B (student passed the exam with grade 9) the error is 73.91% (the percentage of probability for outcome B is 26.09%). The leaf 11 is the leaf with the greatest number of classified instances (396), while the leaf 3 has the smallest number of classified instances (8).

Decision tree for PredmetID = 4 with two independent variables (PredmetID = 1 and PredmetID = 2) is shown in Figure 1.

P values for both predictors are less than 0.05 ($p<0.001$), which indicates that both independent variables (PredmetID = 1 and PredmetID = 2) significantly affect the dependent variable PredmetID = 4.

After development of decision tree, the correlation coefficients by grades were defined. Also, correlation coefficients of independent variables with dependent variable were defined. According to the values of the obtained correction coefficients, it can be concluded that there is a slight correlation between the PredmetID = 1 and PredmetID = 4 ($r_{1,4}$=-0.243), and medium strong correlation between PredmetID = 2 and PredmetID = 4 ($r_{2,4}$=-0.439).

Error matrix showed that accuracy is 59.39%, response 37.49%, precision 37.45 and F-measure 36.48%. Accurately was classified 974 and inaccurately 666 of instances.

Based on defined values for input parameters, i.e. independent courses, it can be defined the probability of results related to dependent course. For example, for the grade 7 on course PredmetID = 1 and grade 8 for course PredmetID = 2, the following path was developed:

1. PredmetID = 2, grade 8 → right branch → node 7
2. PredmetID = 1, grade 7 → right branch → node 9
3. PredmetID = 1, grade 7 → left branch→ node 10
4. PredmetID = 1, grade 7 → left branch→ node 11 (396 classified instances)

The values of probabilities (in percentages) by grades that students will get for PredmetID = 4, if for PredmetID = 1 got grade 7 and for PredmetID = 2 got grade 8, are presented in Table 2.

TABLE II. PROBABILITY OF POSSIBLE OUTCOMES/GRADES

Grade	***10 (A)***	***9 (B)***	***8 (C)***	***7 (D)***	***6 (E)***	***5 (F)***	***(X)***
Probability (%)	2.8	6.2	12.8	16.2	38.0	22.8	1.2

Table 2 shows that for the given percentages of probabilities and defined data for PredmetID = 1 and PredmetID = 2, with grades 7 and 8 respectively, for grades of PredmetID = 4 follows:

- It is almost sure that student will not get the grades 10 (2.8%) and 9 (6.2%),
- Relatively is low probability (12.8%) that the student will get the grades 8 or 7 (16.2%),
- It is the highest probability that the student will get the grade 6 (38.0%),
- It is relative probability that the student will not pass the exam, i.e. he/she will get the grade 5 (22.8%),
- It is almost sure that the student will approach the exam (probability that he/she will not approach the exam is 1.2%).

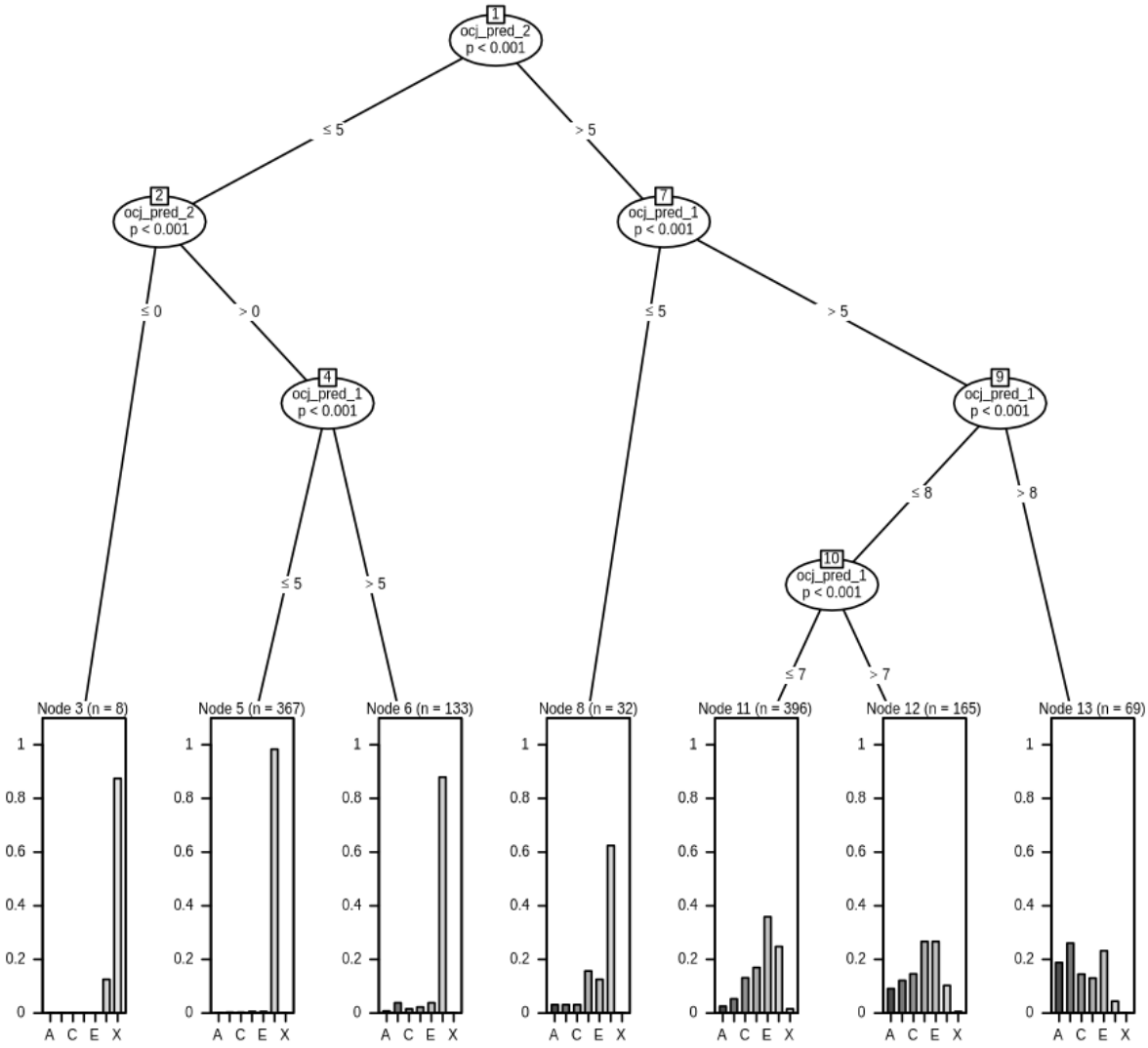

Figure 1. Decision tree for PredmetID = 4(2)

III. CONCLUSION

The results of research presented in this paper show that there is a significant space for use of data mining techniques in order to improve quality of the curriculum development. Namely, decision trees could be very useful when in cases of huge amounts of data is necessary to reach some conclusions and make decisions based on them. In the presented case of curriculum development, the main goal was to research determination of courses within curriculum based on students' assessments. It was shown how established rules could be used in taking specific actions, i.e. determining the sequence of courses within curriculum, all with the same goal – to improve teaching and learning process at the higher education institution. Consequently, data mining techniques, like decision trees, are very good tools which HEIs should use in order to improve their overall quality, and especially quality of curriculum development.

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The Importance of Communication Skills of Employees in Higher Education Institution for Achieving Students Satisfaction

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Abstract - According to the modern management of human resources one of the most important transferable business skills, which ranks among the special transferable business skills is a communication skills. Employees in higher education institutions, teaching and non-teaching staff, play a key role in achieving the satisfaction of students. Therefore, the subject of the article is to establish the importance of communication skills of employees to achieve the students satisfaction. The aim of the paper is to point out what are the communication skills of employees significant, in terms of students, for business of higher education institutions, as well as on how and in which direction the teaching and non-teaching staff should develop these skills in order to achieve satisfaction of student. The research was conducted on a sample of 703 respondents, students of four faculties that are part of the University Business Academy in Novi Sad. As an instrument for data collection was used a questionnaire created for research purposes. Data analysis was performed using the statistical methods (descriptive statistics and correlation analysis). Based on the results drawn conclusions and directions for further research in this area.

I. INTRODUCTION

Students' satisfaction in higher education institutions is the primary business objective of these institutions in the current period. Employees in higher education institutions have a strong influence on students' satisfaction and it is certainly one of the indispensable business segments that should be emphasized. Employees in higher education institutions, as the main intangible property of higher education institutions, play a very important role in motivating and training future employees. Therefore, it is necessary that employees posses developed transferable business skills that will profile them as knowledge workers, enable their self-realization and enable them to realize their professional potential. The aim of this paper is to point out to how communication skills of employees in higher education institutions are significant for students' satisfaction, and to indicate which communication skills are essential for achieving students' satisfaction in higher education institutions.

Communication skills of employees in higher education institutions are presented in the first segment of the paper through relevant literature review. Afterwards, the paper outlines the significance of students' satisfaction in higher education institutions by presenting the attitudes of the relevant authors who have studied this area. In the final part of the paper, we discuss the research methodology, as well as the results which further illustrate the points made in the theoretical part so that the drawn conclusions would clearly led to knowledge on which communication skills should be insisted upon to achieve students' satisfaction.

II. COMMUNICATION SKILLS OF EMPLOYEES IN HIGHER EDUCATION INSTITUTIONS

Human resources management plays an important role in the field of higher education.. The capital some people raise for a company, by means of their characteristics and engagement, some authors [1]. further specify as the human capital, which implies knowledge, skills and competence of the employees in an organization. Therefore, it is important to treat human resources as the capital that needs to be preserved and increased.

Communication skills are one of the many transferable business skills that a knowledge worker should possess in the modern business. Those are the business skills which describe the path, model and the concrete way in which an employee acts. The employees must first be aware of themselves, which will further create the principles they apply, that is, the ideas, beliefs, thoughts and emotions they stand for, express and follow. The preconditions for transforming their potential into useful activities with the aim to manage oneself and the processes in an

organization are created by the process of adoption and development of transferable business skills. Generally speaking, transferrable business skills are a coordinated set of action habits which indicate to what extent an employee is capable of performing tasks, that is, to respond to current and future challenges. From the point of view of acting, transferrable business skills can be divided into general and specific transferrable business skills [2]. Communication skills belong to specific transferable business skills, and they imply the ability to clearly express ideas, the ability to effectively and confidently express oneself orally or in writing, the ability to listen actively and respond, public speaking skills, the ability to use information technology during a presentation, the ability to negotiate and close a deal, the ability to communicate with the members of other cultures, and non-verbal communication skills [1]. When referring to higher education institutions in the era of modern communication, all of the above mentioned communication skills are essential, especially the ability to use information and communication technology during classes, as well as to use modern teaching methods. The ability to teach from another city, country, or continent is one of the significant benefits of the new technology and the internet; whereas the new programs facilitate the work of administration and teachers in the classroom, keeping track of attendance, record of points earned and activities, and all the data are transparent and available to students [3].

Employees in higher education institutions utilize modern technology on a daily basis when teaching, so as to be able to present certain information to students more easily – which is, without a doubt, a developed communication skills. Student-teacher communication is also facilitated and carried out more efficiently. By using information technology, students have easier access to global information and to wider range of sources of certain information. The education process is facilitated and available to all those who wish to take part in it. It is up to the higher education employees to accept this work method as the possibility for enriching the teaching process. Everyday use of modern technology will improve the quality of the teaching process in the classroom, but it will also significantly facilitate the process of learning and acquiring knowledge. It is up to higher education institutions to support and improve this type of communication and teaching process as much as possible so as to increase students' satisfaction [4] In the same way, the modern technology and the use of new communication skills enables the non-teaching staff to do their job more easily considering the speed of information flow between the non-teaching staff (student services, library and similar) – and students. Punctuality and speed in sending information is of the crucial importance for students' satisfaction.

III. STUDENTS' SATISFACTION IN HIGHER EDUCATION INSTITUTIONS

There are many definitions of customer satisfaction. The most significant differences in the perception of customer satisfaction are between the supporters of transaction-specific and cumulative approach to satisfaction [5]. In transaction-specific approach, the emphasis is on the satisfaction after a decision has been made, thus satisfaction is observed as a result of, for example, a purchase occasion, that is, the use of a service, within an organization. On the other hand, the cumulative approach involves monitoring satisfaction for a longer period of time and it includes the customer, that is, their satisfaction generated through all the relations with the organization. Therefore, the overall customer satisfaction is observed. It can be argued that the cumulative approach to satisfaction is more complex and long-term, but for that reason a service organization has the ability to manage the customer satisfaction in a longer run. Forming relationships with customers is reflected in repeated transactions with service organizations and thus the greater satisfaction is achieved, which in return should have a positive influence on the organization's business.

When it comes to higher education institutions, the importance of customer satisfaction cannot be completely identified with the importance it has in other service industries, considering the specific nature of higher education institutions and the fact that the public higher education institutions are not profitable organizations, nor profit can be the primary objective of any higher education institution regardless of the ownership structure. Whereas in the majority of service industries appeals, transmit ion of information by word of the mouth, loyalty, repeat purchases and profit are the result of satisfaction, some of these consequences make no sense in higher education whatsoever. In higher education institutions, students' satisfaction and long-term relationship with students can provide a certain kind of competitive advantage for the institution, especially at the level of positive word of the mouth information concerning potential, current and future students, as well as through a possible cooperation with the institution, especially after graduation, which contributes to the employment of recent university graduates. Students' dissatisfaction, however, can have fatal consequences for the faculty and for

students as well, namely, unsuccessful students who quit or transfer to another faculty and negative word of the mouth information, which is harmful to future applications [6].

IV. RESEARCH METHODOLOGY

The research was conducted at University Business Academy in Novi Sad, which consists of Faculty of Law for Commerce and Judiciary in Novi Sad, Faculty of Economics and Engineering Management in Novi Sad, Faculty of Stomatology in Pančevo, and Faculty for Applied Management, Economics and Finance in Belgrade.

The sample consists of 720 students of all levels and years of study, from all faculty members of University Business Academy in Novi Sad. The random sampling method was used for sample selection. The random sample was selected from the list of undergraduate, master and doctoral studies by using random number tables. Data analysis was conducted after the elimination of incomplete questionnaires resulting in 703 respondents as a final number.

The research was thoroughly prepared. The treatment of respondents was clearly and precisely defined forehand. Clear, accurate and detailed instructions for respondents and associates in the study were prepared. The method for collecting and recording data was defined.

For data collection, the survey method was applied, and the survey instrument was a non-standard questionnaire created for the purposes of this research. By using the detailed analysis of the theoretical data sources concerning the topic in question, by consulting both domestic and foreign authors, key areas, factors and characteristics, on the basis of which the questionnaire with questions whose answers lead to the possibility of processing the desired data and obtaining the desired results, were determined. The questionnaire consists of 16 items, to which respondents answered in accordance with the degree of agreement on a scale from 1 to 7 (1 – I completely disagree, 7 – I completely agree). The questionnaire is divided into 2 thematic areas or segments (the first segment is related to human element factors, with communication skills being one of them, and the second segment is related to students' satisfaction).

Data collection procedure – respondents answered the questions from the questionnaire in groups at the aforementioned faculties of University Business Academy in Novi Sad. Participation in the survey was anonymous.

Data processing methods – The obtained data were processed in SPSS for Windows 17.0 program. The following statistical methods were used: descriptive statistics and correlation analysis (Pearson correlation coefficient).

Hypothesis tested in this research was defined in the following manner:

Hypothesis 1 – Communication skills of the employees are closely connected with students' satisfaction in higher education institutions.

V. RESULTS AND DISCUSSION

The research results indicate the evaluation of communication skills of employees and students' satisfaction in higher education institutions, as well as the connection between communication skills of employees and students' satisfaction in higher education institutions. The results presented confirm the set research hypothesis.

TABLE I. DESCRIPTIVE INDICATORS OF THE EVALUATION OF COMMUNICATION SKILLS OF EMPLOYEES AND STUDENTS' SATISFACTION

	N	AM	Min	Max	SD
Teachers present teaching materials to students in an interesting way	703	5.41	1	7	1.511
Teaching associates practice teaching materials with students in an interesting way	703	5.35	1	7	1.605
Non-teaching staff is polite	703	5.83	1	7	1.518
I am completely satisfied with the faculty where I study	703	5.77	1	7	1.531

Legend: N-the number of respondents (the sample), AM- arithmetic means SD- standard deviation.

According to the results from Table I, we can see that all elements related to communication skills of employees are well assessed at faculties at University Business Academy. However, the politeness of non-teaching staff was assessed the best while the interesting way of presenting teaching materials by teachers and practicing materials with students by teaching associates was worse assessed. This clearly indicates that non-teaching staff has more developed communication skills than the teaching staff, more precisely, students assessed the communication with non-teaching staff better than the communication with teaching staff. From the table above it is evident that students' satisfaction was equally well assessed as the communication skills of employees at faculties where the research was conducted. Hill et al. [7]. and Pozo-Munoz et al. [8]. believe that the teaching staff plays the key role in higher education institution business and that they are in fact responsible for the degree of students' satisfaction. With the stated attitude, the research results are not compliant because the students' satisfaction is well assessed even though students

better assessed non-teaching staff and put an emphasis on the work of non-teaching staff.

TABLE II. CORRELATION COEFFICIENT BETWEEN COMUNCATION SKILLS OF EMPLOYEES AND STUDENTS' SATISFACTION

	I am completely satisfied with the faculty where I study
Teachers present teaching materials to students in an interesting way	0.49***
Teaching associates practice teaching materials with students in an interesting way	0.49***
Non-teaching staff is polite	0.50***

Significant at the level p<0,001

The results in Table II suggest there is weak to moderate correlation between students' satisfaction and communication skills of employees in higher education institutions. It can be observed that the results of the correlation analysis are in accordance with the results of the descriptive statistics and they indicate a stronger connection between communication skills of non-teaching staff and students' satisfaction (Pearson correlation coefficient r=0.50) compared to the connection between communication skills of teaching staff (teachers and teaching associates) and students' satisfaction (Pearson correlation coefficient r=0.49).

VI. CONCLUSION

Both the views of the relevant authors from this research field, and the results obtained from the research lead to the conclusion that communication skills of employees are of great importance for achieving students' satisfaction. Observing separately communication skills of teaching staff (teachers and associates) - whether they present teaching materials to students in an interesting way, and of non-teaching staff, we have reached a surprising conclusion – students are more satisfied with communication skills of non-teaching staff. Furthermore, we have established that communication skills of non-teaching staff are more related to students' satisfaction than communication skills of teaching staff. Therefore, taking into consideration all of the above mentioned findings, we have reached the overall conclusion that communication skills are essential for achieving students' satisfaction in higher education institutions, and not just communication skills of the teaching staff, as numerous authors states, but primarily communication skills of non-teaching staff. Therefore, higher education institutions must encourage the employees from every institution department to develop communication skills, starting from the institution management and all they way to non-teaching staff. All employees who are in direct contact with the students must possess developed communication skills so that students, as users of higher education institutions services, would be satisfied

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Experimental Virtual Reality Space for Smart Environment Development

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Abstract – Smart environment is emerging field of the interest nowadays. There are many aspects which need to be considered to bring satisfying experience. This work is aimed at user interfaces and the smart environment from human-centered perspective. The development process could become time consuming because in many cases the electrical network, sensory network and other physical elements need to be rebuilt to begin another test. Virtual reality technologies could solve this kind of issues low cost and fast. In this work a CAVE system was used in the comparison of standard approaches.

I. INTRODUCTION

Research in the field of smart environments (SmE) is connected with Human-centered Computing (HCC). In spite of the fact that computers are hiding from the user's direct view they stay in close interaction with the user through sensory networks, wearable devices and robot assistants. All these devices with appropriate application software could bring extended solutions in:

- Safety, security and privacy
- Health, wellness and ergonomics
- Resource saving
- Education and training
- Entertainment and convenience.

They are developed with highly human-centered approach (HCA). A human being is not recognized as a direct user of information technologies but rather as someone whose abilities need to be supported and improved. Suitable view on the development of SmE user interface is supposed to be paradigm of localized information including methods and approaches of human factor engineering and cognitive processing. It is important to notice that UI for SmE based on human body movements and activity recognition is strictly bound to contextual data describing conditions under which activities occur [1]. Content of contextual data defines extended information like timestamp, status of physical environment in the form of measurable data and biochemical and physiological data of the user [1].

II. DEVELOPMENT APPROACHES

Emerging technologies of SmE are developed and tested in *living laboratories* [2].

The Aware Home Research Initiative at Georgia Tech is dedicated to exploration of services based in the home with a multidisciplinary approach. One of its research contributions is aimed at building a SmE, which is aware of user's activities and capable to support elderly people. In this way they are supposed to be able to live alone and be more independent on other family members [3].

MavHome project [4] launched at the University of Texas at Arlington is defined by four layers of hierarchical architecture (decision, information, communication and physical). It is aimed at perception and activity prediction. Information gathering is accomplished also through 3D simulator which is not aimed at UI development and simulation of near real-life experience from user's perspective.

Research initiative called *House_n* and it is a Department of Architecture research group at MIT. It is aimed at new technologies in connection with dynamic and evolving places (in the scope of a home, a workplace and a city) that respond to the complexities of life. Home research area includes *The PlaceLab* - the real home environment equipped with hundreds of sensing components. These components provide innovative user interface applications to help people easily control this environment. Inhabitants live in the lab for varying lengths of time and have no contact with researchers. Collected data are analyzed off the site [5].

Approach of living laboratories provides testing similar to real life situations occurring at home and it is suitable for collection of significant data for improvements. These improvements may require changes at several layers of SmE and rebuilding of

interior, which could be expensive and time consuming. Several insufficiencies could be overcome by SmE virtualization without the loss of credibility in particular UI tests.

III. SMART ENVIRONMENT AND VIRTUAL REALITY

SmE includes components which could be divided into two categories, sensors and actuators, which offer "off screen" interaction. We can control and monitor physical environment where we live using posture, gestures, speech and hand writing. The user interface which is inspired by natural way of communication is capable to fulfil requirements of easy understanding and learning to work with the user interface.

Realization of such an interface is possible by involvement of known input of such an interface is possible by involvement of known input and output devices which are widely used in navigation in variety of virtual worlds. Technologies of virtual reality (VR) are supposed to be used to simulate SmE to evaluate new ways of interaction and also to become a part of the SmE itself. There are two widely used techniques to deliver immersive and semi-immersive experience of virtual reality with satisfying predictions of desired results for SmE virtualization.

A. *Head-mounted displays (HMD)*

These devices are suitable devices to bring virtual environment to one user at a time. They are becoming highly portable and available for a price with a decreasing tendency. Most popular and available HMDs include *Oculus Rift, HTC Vive*, and *PlayStation VR*. Sensing of user's movement could be provided by cameras and motion capture systems. Recorded outputs have to be mapped to virtual objects representing human body parts.

B. *Cave automatic virtual environment (CAVE)*

CAVE is a room-sized space consisting of several projection walls. Despite the stereoscopic projection is adjusted according to one user's view, others could share the same virtual environment without additional cost on view change synchronization. The user can freely move in the space of a CAVE and experience his/her body in close interaction with virtual scene, mostly through contactless motion capture system.

IV. TECHNICAL EQUIPMENT

For providing the experience similar to the living laboratory physical space, it is appropriate to virtualize SmE using the *LIRKIS CAVE* system shown in Figure 1. Requirements include the possibility of rapid prototyping and sharing a

Figure 1. LIRKIS CAVE system during educational process

virtual scene with multiple people. Another advantage is usage of real electrical appliances and other devices inside of the physical space of CAVE.

The system includes 20 stereoscopic screens in a non-cubic layout, spatial sound and user's movement is captured using a markerless *Optitrack* system. LIRKIS CAVE engine consists from three parts:

- Control Center
- Java Console
- Video Renderer

Control Center is the core of the system and it is required to mediate the communication between other parts. *Java Console* is used for the remote control of the whole system and also provides opportunity to interact with currently loaded virtual environment. *Video Renderer* is responsible for 3D scene rendering and it is based on *OpenSG toolkit* [6]. Scene package includes textures and 3D models. Additional logic and interaction with enhanced peripheral devices is implemented using Ruby script, which is included in the package. Thus the system requires only changes on the level of the scene.

V. SUPPLEMENTARY USER INTERFACE

From the user's perspective we identified two most common ways of interaction with a SmE:

1. Natural user interface (NUI) in the meaning of hands-free interaction based on human body movements, speech and other activities captured using sensory network.
2. Monitoring and control through personal smart and wearable devices.

Therefore supplementary user interface for LIRKIS CAVE system was developed. The main part of the whole system - *Unified user interaction resolver* - was designed to provide opportunity to experiment with both types of interaction in cooperation. This component is designed to mediate interaction with the LIRKIS CAVE engine and also to the potential non-virtualized SmE and other clients through API. Conceptual model is shown in Figure 2. The user disposes with ability to monitor and control SmE using Android application installed on his/her smartphone device. Supplementary user interface development was aimed at two parts.

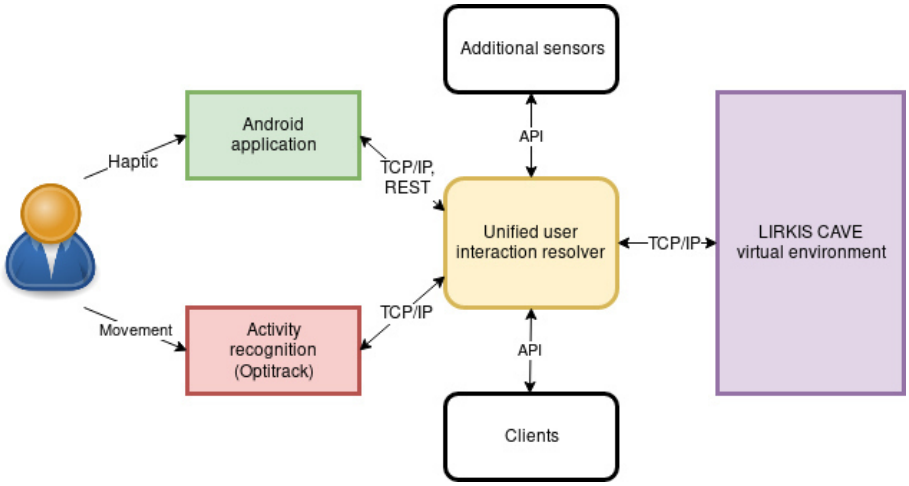

Figure 2. Supplementary user interface for LIRKIS CAVE

A. *Unified user interaction resolver*

This module is responsible for data acquisition in the form of captured users' movements, their storage and analysis. User's movement data is captured and transferred by *Optitrack* system placed in the space of LIRKIS CAVE. In this early stage of development it supports movements based on stereoscopic glasses spatial position change. If a movement is recognized for the first time, the user is notified of its occurrence per Android application. If this movement is recognized again and its purpose is set, the particular action is mediated to LIRKIS CAVE and the change of scene is performed. Module is also capable of providing status of virtual SmE and communicates with additional sensors. This data will be used for collection of contextual information to evaluate the circumstances under which user's activity occurs. API communication extends scalability of the system as it provides opportunity for other application software.

B. *Android application*

Android application is used to notify the user about his / her activities performed in the space of LIRKIS CAVE. Sequence of movements could be set for control of particular devices and electrical appliances placed in virtual SmE. One sequence consisting from three to five movements can be used to create this kind of a gesture. The application provides possibility to edit and remove already set gestures. The user can also change the state of a virtual environment using application directly (without the need to create a gesture).

Figure 3. Virtualized smart environment

VI. VIRTUALIZED SMART ENVIRONMENT

A particular effort was dedicated to the modeling of a SmE scene. The user can freely navigate through virtual space by his/her own moves. LIRKIS CAVE also disposes with advantage of the use of particular peripheral devices like joysticks and gamepads.

Several experiments were aimed at dynamic lighting to bring more realistic experience. Best results were achieved with baked textures because other approaches become highly demanding on computational power which causes low frame-per-second rate. Vividness of the environment was improved by skyboxes with photographs and photorealistic rendering.

During this phase were built two scenes of smart environments - a living room and a kid's room shown in **Error! Reference source not found.**. Each of them includes two types of devices. There are devices with two states (on/off) and devices with configurable properties e.g. color, volume and others.

VII. CONCLUSION

This work deals with new approaches to the development of smart environments from a human-centered perspective. Initial stages were focused on the identification of issues in the classical approach. We proposed a new solution with the use of VR technologies. LIRKIS CAVE system is the space where the near-life experience could be tested and additional changes in the virtual scene are performed without significant effort. Early stages of supplementary user interface development were finished. Whole system is in usability testing phase. Next effort will be dedicated to implementation of communication with additional sensors (EEG, a galvanic skin resistance sensors etc.), acquisition of rich contextual data and better user's activity recognition.

ACKNOWLEDGEMENT

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Hybrid Mobile and Cloud Application for Machine Maintenance

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Abstract - Current stage of technology where all of us is armed with some model of smartphone or tablet device allows us to complete our tasks at work and to communicate with the colleagues without needing anything else. In this paper, we are going to explain development of mobile hybrid application for machine maintenance which goal is to improve the communication and informations sharing between production and maintenance department in some company. The application consists of two components: cross platform hybrid mobile application supporting variety of mobile platforms and cloud database which additionally includes user authentication method used in the application.

I. INTRODUCTION

Mobile devices with their every day stronger capabilities, larger screens, unlimited Internet access and wide range of services such as communication, entertainment, social networks, news, etc. evolved in devices that can be used in almost every field of human acts. Mobile devices capabilities won't mean anything without millions of avaiable mobile application (The Apple App store boasts close to 2 million of these apps while Google play has over 2.2 million Apps [1]) that make our life looks more interesting, communication with our friends and colleagues simple and completion of our daily work tasks easier.

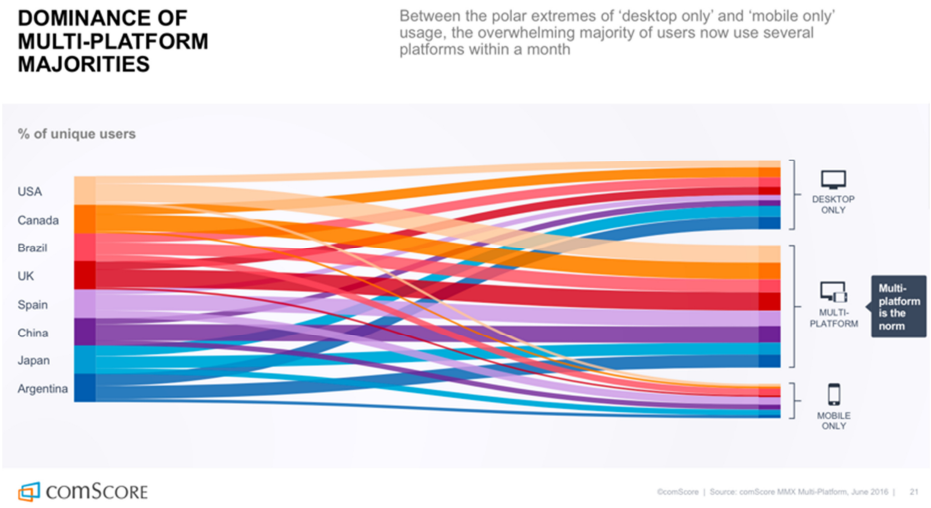

Figure 1. Dominance of multi-platform majorities

Source: http://www.smartinsights.com/mobile-marketing/mobile-marketing-analytics/mobile-marketing-statistics/attachment/use-of-smartphone-vs-desktop-vs-tablet-devices-internationally-2/

There are many operating platforms that run on mobile devices with different structure, based on different technologies and programming languages. This made development of mobile applications complicated. It is fact that majority of consumers are multiplatform (Figure 1) and will often be multi-screening, accessing sites on different mobile devices, laptop and desktop running on variety of operating platform, so consistent experiences across device need to be deployed [2].

Good communication and information sharing between different departments in one company (especially bigger and production companies) is crucial for their success and productivity. The objective of this application for machine maintenance is to reduce the waiting time and

machine downtime by improved communication between production and maintenance department. The application schould be fast, easy to use and cross-platform.

II. APPLICATION ARCHITECTURE AND TECHNOLOGIES

Many mobile technologies and development frameworks are avaiable today which are providing communication and information sharing services. One of them is the Ionic framework – open source SDK (Software Development Kit) for development of hybrid mobile applications. Ionic framework combined with Apache Cordova and AngularJS framework is perfect combination for development of hybrid mobile applications with good user interface.

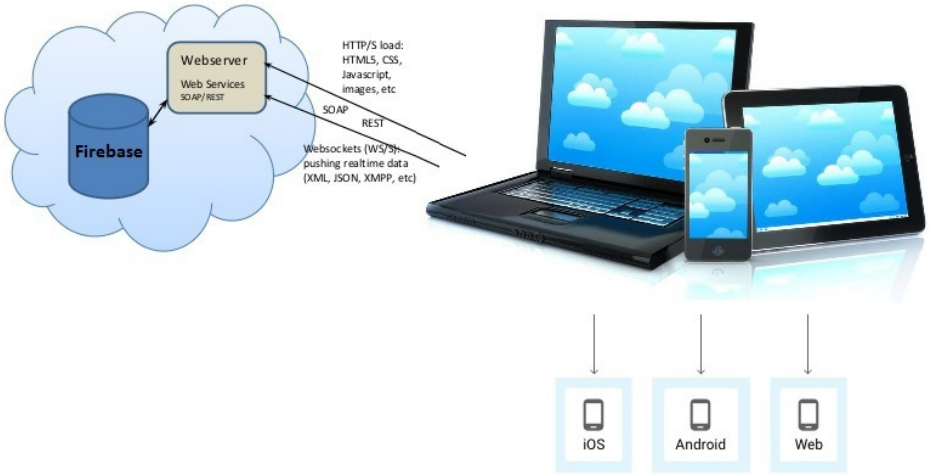

Figure 2. Application architecture

The application architecture is shown in Figure 2. Two main parts can be noticed in the figure: Client side - hybrid mobile application installed on mobile devices and Server side – web server connected with Firebase database.

Exchange informations among the applications and web servers is based on SOAP or REST principle. SOAP causes big network trafic, higher latency and proccessing time, so REST is used to overcome this SOAP's limitations. It's lightweight and easy web service based on different mobile environments. Web services are platform independent. REST design style is network architectural, because it depends from HTTP, HTML and other web technologies. For transactions between the sides are used fixed set of HTTP methods like: GET, PUT, POST and DELETE. All transactions are independent and unrelated to the previous transaction. These principles make the REST application simple and lightweight [3].

Firebase is a cloud-hosted database which stores and synchronizes data [4]. Firebase is NoSQL database which stores data in JSON format. The same data structure format is used to transmit data between the server and the web application. The data is synchronized in real time accross all clients and remains available even when the application goes offline. A single Firebase node offers up to 100 connections per second in its free edition [5].

Firebase Realtime Database SDK persist data to the disk, so once connectivity is reestablished, the client device receives changes that it missed, synchronizing it with the current server state. Building own authentication system can be a pain process: setting up secure servers, building the entire back-end, it can take a while when all you really want is to focus on making your app great.

There are security rules and data validation avaiable through the Firebase Realtime Database Security Rules and expression-based rules that are executed when data is read or written. Firebase offers user authentication method, which is pretty easy to be implemented.

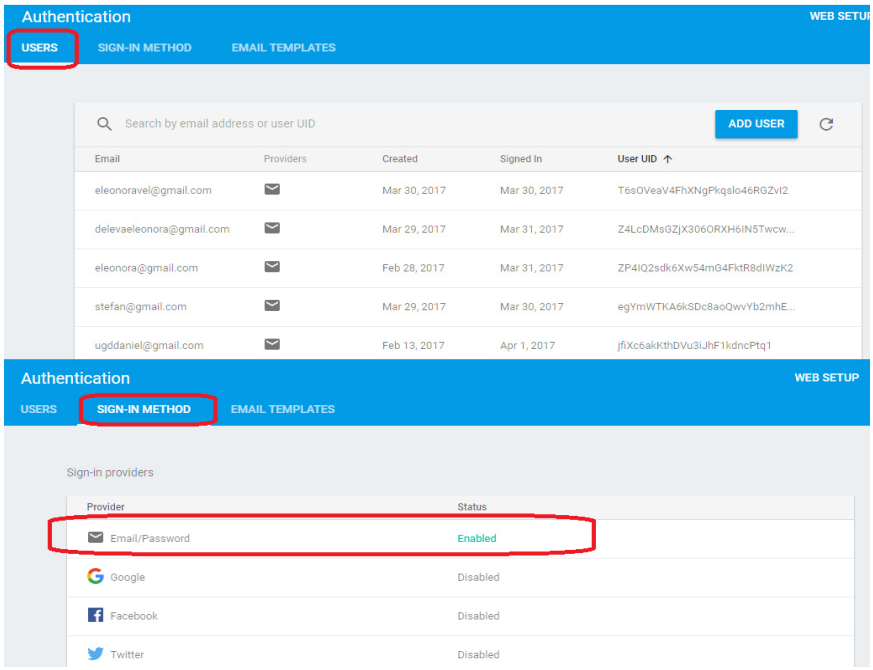

Figure 3. User autentication in Firebase

The authentication method works with some of the most commonly used Sign-in providers as: Email/Password, Google, Facebook, Twitter and GitHub. We use Email/Passwod sign-in method, but if it is needed additional sign-in methods can be added in the future (Figure 3). Additionally, there is easy way to add new user for the app, review actual user list and setup reset password method.

A. Application interface

For the user interface and interaction between users and application is used Ionic 2 framework. Ionic Framework is free and open source project, licensed under MIT, powered by a massive world - wide community [6]. Applications developed with Ionic framework work and look beautiful wherever they run. This is thanks to many features that it provides to developers. Some of the features are high-level building blocks called components. Components allow quick construction of the user interface for the applications [7]. Another feauture are over 120 native device features like Bluetooth, HealthKit, Finger Print Auth, and more with Cordova/PhoneGap plugins and TypeScript extensions. Ionic framework is focused on building native/hybrid mobile applications rather than mobile websites.

The components layout in the graphical user interface is organized by HTML document. With help from AngularJS framework, Ionic provides dynamic style and view for the application components.

The mobile application interface of our app is shown in Figure. 4. From the left side is the start screen which includes: name of the app, application logo bellow the name and two buttons. This two buttons offer two ways to start using the app: Sign up or Log in. After successful sign up of new user, the user is automatically logged in and redirected to the main screen of the app.

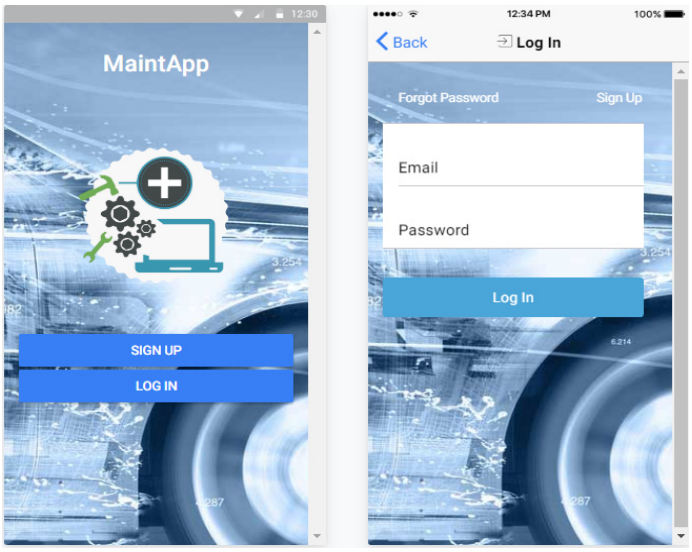

Figure 4. Start screen and Log in screen of the app

There are two types of users: normal and admin users. App functionalities are depending of the user type. The normal user can report for defect on the production line (Figure 5 – right side) and make a review of: list of the machines, shifts schedule and phonebook for the employed in maintenance department. The admin user has additional features including: editing information's about the machines and adding/deleting machines (Figure 5 – left side) and closing a defect report. When closing a defect report, admin user must enter informations about taken actions that helped to solve the defect on the machine.

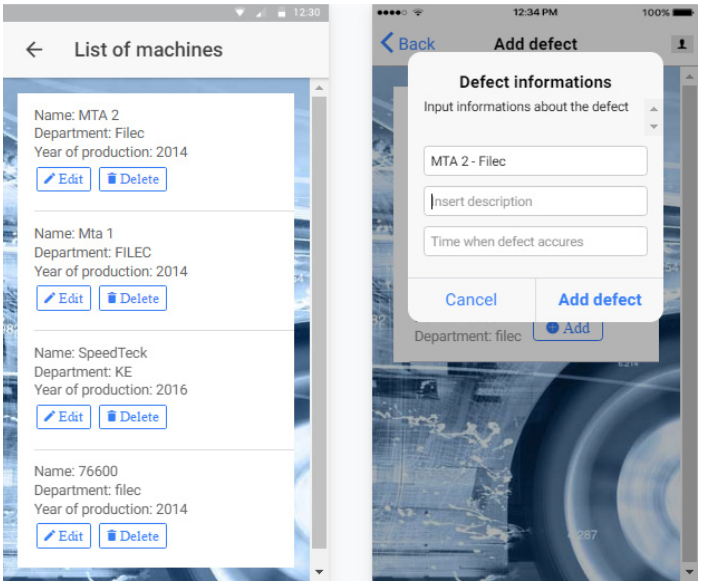

Figure 5. Admin user feature to add/delete machines – left side, Normal user feature to add defect report

III. Discussion and Conclusions

The reason why this kind of application is developed comes from researches made in some Macedonian companies about their productivity. The relsult from the research is that most common reason for biggest downtimes on the production lines is bad communication between the departments. The plan is this application to be installed in one company for testing of its performance and functionalies in realtime. After the testing time, according to the expirience that will have users of the app some updates will be done and the app should be used in the production at the start of 2018 year.

If the use of the application makes good impact on company's productivity, the application will be

offered to other companies that have similar problems. Also, some web services migrations or cloud solutions changes will be done if they are needed.

In this paper is described a hybrid mobile application for machine maintenance, which goal is to improve the communication and informations sharing between production and maintenance department in some company. Additionally a basic discription of the technologies used for development of the app is given.

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Interactive Environment for Technology and Entrepreneurship Learning Through the Means of Information Educational Resources in the Secondary Education

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Abstract - The globalization of the economy and the transition to the information society require new type of competence of the individuals in the area of the education. Such are the technological, informational and entrepreneurial competences. The training in the discipline "Technology and entrepreneurship" in the secondary education is performed in a new information educational environment determined by the use of contemporary ICT means, digital teaching resources, and cloud technologies in the educational process.

A characteristic feature of ICT is their interactivity. As new technologies are becoming an increasingly important element of the learning environment, the debate about their advantages and limitations on the effectiveness of teaching, learning and pedagogical communication has not abated. Today's adolescents live in a highly interactive environment, communicate, and acquire knowledge and skills in the digital world, using different technological means. The classic methods in training are more often complemented with the capabilities of electronic platforms and learning resources. The article explores the importance of technology-enriched learning environment and new requirements that it places on the quality of technological education and in particular to the preparation of the teacher of technology and entrepreneurship in the Bulgarian school.

I. INTRODUCTION

New challenges that contemporary society poses to the school, require the use of various strategies for active learning. Modern educational priorities highlight the need to break traditional stereotypes in teaching and learning and seeking a balance between tradition and innovation in educational practice of teaching the subject "Technology and Entrepreneurship". This would undoubtedly increase the motivation to learn and lead to the achievement of lasting cognitive interest among students. The constantly developing technology causes transformation of the learning environment. Building a modern educational environment with integration of new technologies, combined with interactive teaching methods and approaches, resulting in a change of positions teacher - student in the system of pedagogical communication transforms students into an active partner in the learning process. Expectations are limited to organizing a modern school environment that enables qualitative transformation of education and implementation of attractive, modern and efficient education.

A. Specificity of Modern Educational Environment for Training in the "Technology and Entrepreneurship "

The subject "Technology and Entrepreneurship" is in the structure of general education in junior and first high school level. In the content of education are reflected by the current approaches to the formation of technological culture and economic literacy among adolescents. It is structured in six areas of expertise through which the key competences for lifelong learning are implemented.[6].

Preparation of students is aimed at expanding the digital and technological competence and economic enrichment of knowledge and skills. Leading approaches: learning search and discovery modular-integrative approach and learning by doing. Educational environment provides students with access to specialized surgeries where to run educational activities with intellectual and practical characteristics. Work on the project provides an opportunity for self and team developing ideas on the topics of the curriculum. Promoted are initiatives for activities related to organizing and conducting school fairs, exhibitions and competitions in engineering, technology and entrepreneurship during the school year. [7].

In its first stage, the secondary education provides an upgrade of technological and entrepreneurial competence and of interest to the profession. Foreseen are practical exercises in manufacturing, service and agricultural enterprises in the real working environment. These activities are aimed at the acquisition of labor competencies in technology, public and civic competences, and ability to support sustainable development. As they age the students gradually deepen their knowledge and practical skills through visits to sites for observation of actual production process and working environment. This provides an opportunity for students to see real automated workshops and bays, to learn about the jobs of the people who serve them, to comment on the economic impact of automation. Students develop individual or group project assignments on a specific business idea, discuss and present their ideas publicly in front of parents and guests. The students justify the resources and the technological process, and the need for specific goods or services in the school environment. [8]

The new philosophy of person-centered educational process implies a reform in the content and the procedural part of the training, breaking the accepted status quo by reducing the distance between teachers and students. Attempts are being made for the updating of the didactic tools in respect of the techniques, methods and use of information and communication educational technologies.

Technological innovations in the educational activity change the styles of teaching and learning and justify the creation of a new educational environment. The problem of organizing the training in an interactive learning environment attracts the attention of many researchers. Learning environment, according to V. Gyurova is a set of interrelated organizational teaching methods and tools that underlie the development of teaching and provide training based on imitational practice oriented approaches. [1].

When organizing training in terms of interactive learning environments are changing roles of teacher and student, i.e. subject-object system training organization gives way to subject-subjective. According to the modified educational paradigm:

- The aim of the training is not the process but the result that the student reaches himself;
- Students are motivated to independently derived knowledge and to design solutions that make learning appealing and attractive;
- New knowledge and scientific facts, laws and regularities are absorbed in their logical interconnection and conditionality;
- The forms and methods of organization of training are changing, resulting in it acquiring activeness nature;
- Real life skills and competences for action are formed.

Technological knowledge, skills and competences are formed by supplementing the already constructed, i.e. new knowledge is constructed based on existing knowledge and practical experience of the student. In practice realized mechanism "learning by doing" in which each student solves the problems and tasks according to their individual abilities and preferences

Interactive educational environment in project-oriented technology training is seen as an alternative to the traditional classroom environment. Properly organized learning environment provides conditions for productive interaction in the learning process, for greater dialogue between participants in the process which converts the student in an active subject of knowledge, and the teacher - in partner. Such a learning environment suggests the use of interactive forms and methods of training, promotes the comprehension of content and reaching higher educational results. [3].

In Figure 1 some requirements to the interactive environment of training in technology and entrepreneurship in the Bulgarian school are shown.

Technology-based system of learning is developed on dialogic interaction between students with the support and mediation of various technical means. In light of this development, e-learning is seen as part of the modern educational environment and a variety of active learning.

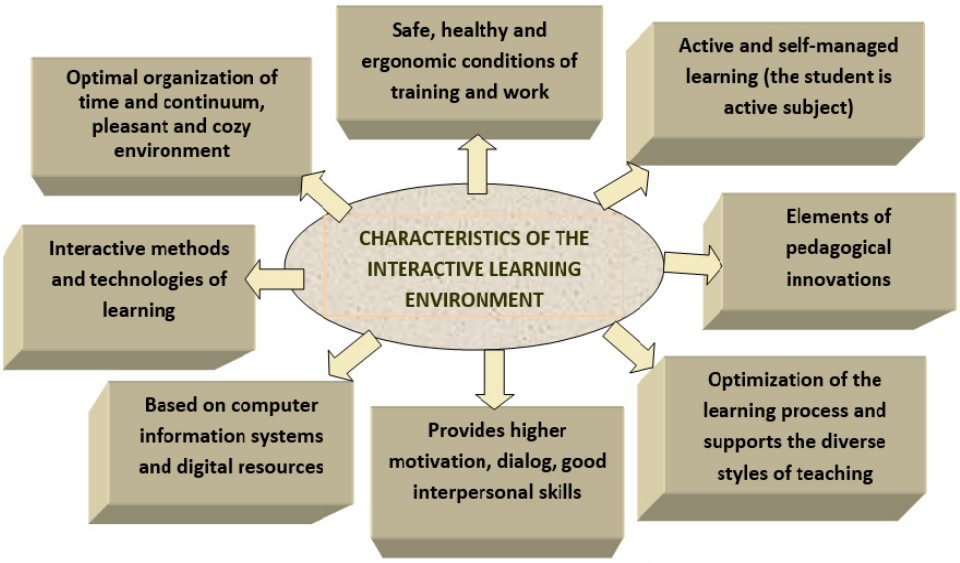

Figure 1. Requirements to the interactive environment of training in technology and entrepreneurship [D. Mitova, 2011]

B. Digital Tools of Technological Training

An important prerequisite for setting up educational environment for training in technology and entrepreneurship are the hardware, software and networking provision of the learning process. The strategy for effective implementation of ICT in the Republic of Bulgaria (2014-2020) found that access to computers, terminals or mobile devices in Bulgarian schools is lower than the average of this indicator for the European Union [5]. Information and communication environment is not uniform. It lacks sufficiency in quantity, quality, compatibility and interconnection online digital content to adequately conduct educational activities in line with the introduction of dual trends and continuing education and lifelong learning. Therefore, the key support elements for the success of the strategy are building a unified ICT infrastructure, digital content and ICT training of teaching staff. It is declared that the mobility of everyone involved in the educational process should underpin the educational process and modern trainer must have permanent access to electronic educational resources and services.

Trends in educational policies regarding the characteristics of new classrooms are connected with the provision of modern computer technical training tools, network connections, training software tools and web services, cloud services based on centralized storage and information processing, flexible management mechanisms resources and remoteness of the user.

The effectiveness of computer-assisted training in technology and entrepreneurship depends greatly on the software provision of this type of training, manifested in the use of digital tools. As a broad concept digital instruments cover except computers, computer technical training tools (tools for visualization, processing of digital information, interactive electronic communications, network connections, computer-controlled and automatic models), as well as software and web-based resources. Methodical software complexes, representing a set of programs with an educational purpose, individual materials for students and methodological guidelines for teacher, are developed.

They may include:

- programming or web-based teaching tools - computer based training, simulators, models, simulators, interactive animations, digital textbooks, augmented reality, computer games and other electronic educational resources;
- Reference and information resources (encyclopedias, reference books and other sources of digital information);
- Standard tools for practical information activities- word processing systems, image editors, agents for treatment of audiovisual and multimedia information;
- Application software to solve engineering, technology or design educational tasks. For example software for interior design, design schemes, furniture and other objects, photo editing, creating and editing video information management systems and other sensors for automatic control

- Web services or resources assessment and self;
- Software for electronic communication and global network

The toolkit includes the teacher and specialized pedagogical tools such as:

- Digital tools to design teaching materials and training tools - software or network tools to create posters, tests, crossword puzzles, lesson plans, animation and other teaching materials;
- Software for management of student project work, etc.;
- management systems of learning;
- Specialized databases;
- Diagnostic tools and controls;
- Affordable or shared web resources related to the construction of pedagogical design for learning (lesson plans, visual aids, videos, methodological developments, etc.);
- Networking tools for self and professional development.

The methodical software complex must have a dynamic composition, easy to modify and adapt to the conditions. The Educator selects and combines a system of appropriate technological tools for learning programming resources and other digital tools meeting specific teaching requirements - degree of impact, adaptability, interactivity and others. The educator organizes the system of management, prognosis, and modeling, to direct and coordinate the activities of students in a complex environment in different time and space communication impacts. It is necessary to ensure diversity and create a certain psychological and pedagogical concept of application program elements methodical complex.

In the initial stages of appearance of ICT in Bulgarian education, the selection and use of digital tools for technological training depends entirely on the attitude of teachers towards informatization and the level of their digital competences. In most of textbooks used tasks related to the study of electronic web published materials are assigned. In some cases the recommended software or network services that can be used as instruments for practical technological activities of students. The use of electronic resources offers opportunities for enrichment and extension of the information environment for technological training, increase interactivity and, in some cases, achieving some personalization of learning.

Another option for digital didactic provision of training in technology and entrepreneurship development constitutes copyright training materials by educators in technological training or adapting to use free resources from the Internet. The market for digital educational products evolves and becomes increasingly globalized. The number of available repositories for learning objects is constantly growing. The technologies are becoming more mobile and compatible. Specialized educational platforms are created, some of which offer online cloud technologies for learning.

Computer saturation of the educational environment requires complex coordination for optimum distribution of functions of the teacher, students and resources for training. Questions about the location of the hardware organization of workspaces and managing interactions technologically insured classrooms or specialized laboratories acquire actuality. Training in technology and entrepreneurship requires specific solutions for organization of workplaces, because in this case should rationally to combine access points and digital information processing and specialized places manipulative and operating a variety of tools, machines and materials. [2].

Achievements in digital and network technologies and the rapid dynamics create conditions for rapid change and development of elements of educational learning environments, their spatial organization and methodical use. The educational environment should be dynamic, diverse, constantly changing and evolving.

Major trends among training [9] are: use of interactive communication tools; using customized computer devices for learning; access to real data when necessary; web-based surveys with fast data processing; web conferencing; creating conditions for realization of project based learning. Trends in educational policies regarding the characteristics of new classrooms are connected with the provision of modern computer technical training tools, network connections, training software tools and web services, cloud services based on centralized storage and information processing, flexible management mechanisms resources and remoteness of the user.

Informatization of technological education requires constant enrichment, expansion and development of the information learning environment for the realization of its goals and objectives in a changing technical world.

C. Conclusion

The use of ICT is an integral part of modern technological education in Bulgarian schools. The

new type of "digital" learners perceives the world around them through technology. In the Bulgarian school, various means to support technological learning: computer systems, multimedia projectors, interactive boards, multimedia systems, interactive devices and others, are used. They can complement and build upon, through appropriate and consistent with the age of the students, software tools such as electronic textbooks, platforms for creating, publishing, storing, searching and sharing of electronic learning resources. The requirements for the teachers of Technological training are also growing. The need to be well qualifies and prepared to use specialized resources in internet to assist their work together with cloud services and platforms under the conditions of interactive educational environment.

Attitudes and expectations of today's students challenge the teacher to be highly creative, to continually diversify the methods used in their work in orderto be adequate to the requirements of the time.

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Pupils' Workload by Educational Content of Technical and IT Education

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Abstract - This paper shows results of action research with the goal to implicate attitude of elementary school pupils toward workload by technical and IT educational content. We may often hear from pupils and their parents, that the teaching material is too extensive and that some educational contents are not age appropriate. Results of this research confirm the assumption that order and extent of adoption of certain educational content from the subject Tachnical and IT education represent factors of elementary school pupils' workload. Equally, comparative research of teaching plans and programs of school systems in the region (Babić-Kekez, 2016.) show the need to reform our elementary school system and to create new education policy.

I. INTRODUCTION

The goal of teaching in technical and IT education and upbringing in elementary school is to familiarize pupils with technical-technological achievements through acquisition of basic technical literacy by developing technical thinking, technical culture, working skills and working culture. Modern school should be a place where you can create conditions for pupils' unrestrained personal development, a place which can provide useful and useable knowledge without overloading the students.

Comparative research of teaching plans and programs of school system in the region (Babić-Kekez, 2016.) show the need to reform our elementary school system and to create new education policy. Some research show that average workload on a daily and weekly basis is sometimes higher than the one for working people. Beside the fact that these situations lead to overworking which reduce learning effects, it may be pupils' health hazard. Pupils, parents, and the majority of teachers point out that the teaching material is too complex and extensive. It is undeniable, the progress of science and culture has reflected on school programs and workbooks. Teachers teach extensive content during a small number of teaching hours, so they do not have enough time to establish it with pupils and have to give the rest of the content to pupils as homework. This is one of the reasons for pupils' workload. Domination of frontal work method and the use of traditional methods in teaching leads to a passive role of pupils in class.

Traditional teaching method forces the teacher to pay more attention to the teaching material instead to the pupils studying that material. In order for the school program to arouse interest of pupils, it should be adjusted to the interests of pupils as much as possible. Teaching program should also be adjusted to pupil's individual abilities and possibilities. That kind of content is easier to adopt, it is better and longer retained. Form of teaching which assures individualization, independence and universal activity is better for pupils.

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II. RESEARCH PROBLEM

Pedagogical encyclopedia gives different approaches in comprehension of workload, for example, class hours, extracurricular activities, load of content outside of school daily, weekly, yearly; what is the load of extent and depth of content, homework and additional subject load with individual teachers, subsequently methods, systems and forms of work, etc. (Ped. Encyclopedia, 1989)

In order to succeed, school must gravitate towards optimal load of pupils. That means that schoolwork should not be too light or too heavy. However, in almost every study based on this problem authors point out that pupils' workload surpass their psychophysical abilities.

According to I.Furlan (1977.), the appearance of workload must be known, tracked and measured, and not in any way considered unsurpassable as some dominating occurrence.

According to M.Matejević (1995.), research carried out by Biondić, Rozmarić, Furlan, Ivić, Pešikan, Lazić, Krulj, Brkić showed that pupils' time consumption is high and that is gradually growing from fifth to eight grade of elementary school. Ivić addresses this problem from three points of view:

1. quantity (temporal) workload of pupils
2. intellectual workload (workload of extent and gravity of content, workload from the method of its presentation and teaching)
3. physical and physiological workload of organism – workload from different types of activities and incapability to rotate different activities throughout the teaching process.

When we speak of workload caused by extent of content, it is not only the time needed to surmount it being considered. It is also the amount of information that a pupil needs to accept, and the extent of appropriateness of that content. Volume and level of gravity of the content adapts to the pupil based on psychological findings of his/hers intellectual growth, respectively considering the principle of individualization.

Selection and order of content in teaching program depends largely on understanding the role of teaching on the cognitive development of the pupil.

The question imposing is if the contents given in the program and workbooks, as well as the extent, order and method of its adoption, may be of importance to cognitive development of pupils or if it represents a factor in the pupils' workload.

III. METHOD OF RESEARCH

A. Goal and Tasks of the Research

Goal of this research is to establish the opinion of pupils about the educational content in the subject Technical and IT education, which is given in the program and workbook; if it is a factor in workload of pupils.

Based on the goal of research, tasks which follow are:

1. To establish whether the extent of material in the subject Technical and IT education is a factor in workload of pupils
2. To establish if the order of adoption of educational content in the subject Technival and IT education can be a factor in workload of pupils

B. Hypotheses of the Research

Hypotheses of this paper may be established based on the latter stated as a problem of research and showed as the goal and tasks of the research.

In accordance with the goal set, basiv hypothesis is: The extent and order of adoption of educational content in the subject Technical and IT education is a factor of elementary school pupils' workload.

Based on the tasks of the research, we may postulate the following hypotheses:

1. The extent of material in the subject Technical and IT education can influence the pupils' workload;
2. Uneven order of adoption of teaching content in the subject Technical and IT education can be a factor within pupils' workload;

Basic hypothesis will be checked with special hypotheses.

Action research used descriptive method. Technique of questionnaire has been used, as well as instrument of a survey for pupils which is anonymous. The grades which descript pupils' attitude toward the offered statements were nominated as:

- I completely disagree: grade 1
- I mostly disagree: grade 2
- I am not sure: grade 3
- I mostly agree: grade 4
- I completely agree: grade 5

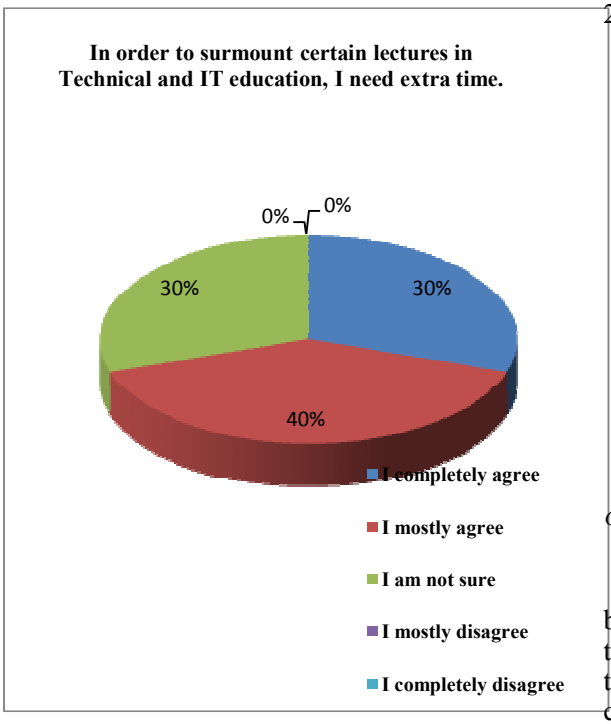
The research was conducted in elementary schools in Zrenjanin, Srpska Crnja, Sečanj, Radojevo, Srpski Itebej, Aleksandrovo and Međa, in classes of seventh and eighth grade. Examination covered 220 pupils. Quantity data processing was made using MS Excel package.

IV. RESULTS OF RESEARCH AND DISCUSION

Statements in the survey which determined pupils' attitude:

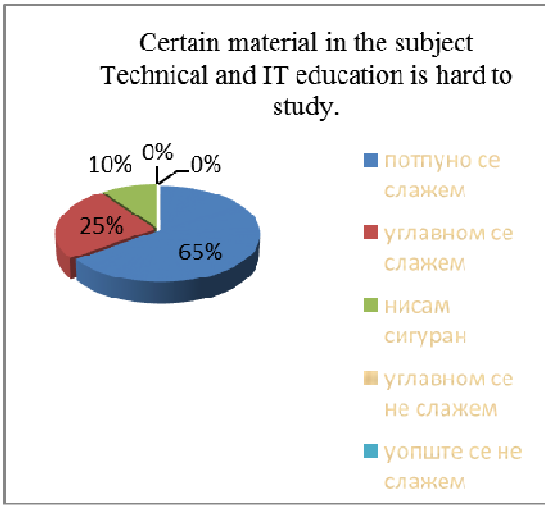
In order to surmount certain lectures in Technical and IT education, I needed extra time.

By analyzing answers to the given statement, it may be concluded that the majority of pupils consider that they need the extra time in order to surmount certain lectures in Technical and IT education. 30% of pupils completely agrees; 40% mostly agrees; 30% is not sure. There was not one pupil that disagreed.



Graph 1 Analysis of the statement from the pupils' questionnaire

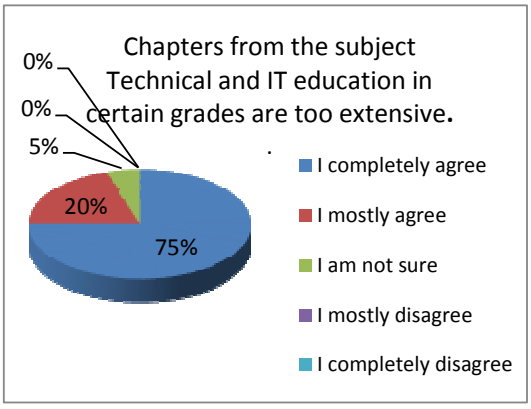
1. Certain material in the subject Technical and IT education is hard to study.



Graph 2. Analysis of the second statement from the pupils' questionnaire

Analyzing answers to the second statement, it can be concluded that the majority of pupils thinks that certain material in the subject Technical and IT education is hard to study. 65% of pupils completely agrees; 25% mostly agrees, and 10% is not sure. Not one pupil disagreed. There are lectures in the subject Technical and IT education that are unnecessary.

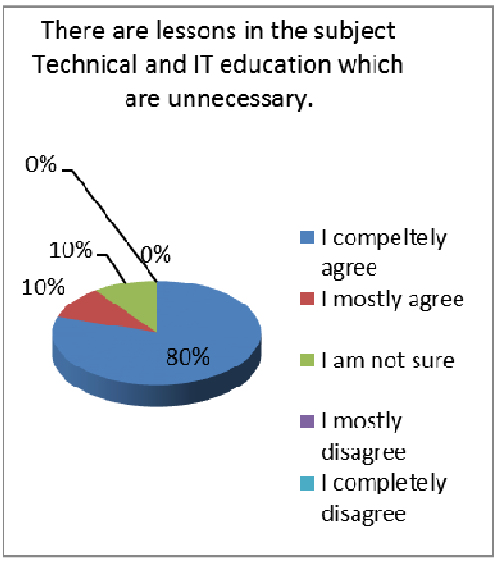
2. Chapters from the subject Technical and IT education in certain grades are too extensive.



Graph 3 Analysis of the third statement from the pupils' questionnaire

Analyzing answers to the third statement it can be concluded that the majority of pupils considers that chapters from Technical and IT education is too extensive in some grades. 75% of pupils completely agrees; 20% of pupils mostly agrees and 5% is not sure. Not one pupil disagreed.

3. There are lessons in the subject Technical and IT education which are unnecessary.



Graph 4. Analysis of the fourth statement from the pupils' questionnaire

We can, based on the answers to the fourth statement, conclude that the majority of pupils considers that there are some unnecessary lessons. 80% of pupils completely agrees; 10% mostly agrees; 10% is not sure. There was no pupils that disagreed.

Special hypothesis: The extent of material from the subject Technical and IT education may influence pupils' workload, has been confirmed

through analysis of pupils' questionnaire, respectively analysis of answers to the statement 1, 2 and 3 from the pupils' questionnaire. Special hypothesis: Uneven order of adoption of the teaching material in the subject Technical and IT education can be a factor to pupils' workload, has been confirmed through analysis of pupils' questionnaire, respectively analysis of answers to the statements 3 and 4 from the pupils' questionnaire.

V. CONCLUSION

Goal of this research is to establish attitude of pupils toward teaching content in the subject Technical and IT education, the extent, order and method of its adoption represent the factors of elementary school pupils' workload.

Based on the analysis and discusion of the results, it may be concluded that basic assumption is confirmed, respectively the extent and order of adoption of certain teaching material in the subject Technical and IT education represent factors of elementary school pupils' workload. It is necessary to radically change the position of pupils and teachers inside the teaching process.

Experts in their work reasonably point out the need to overcome traditional teaching. It can be achieved by modernization and rationalization of teaching. As a consequence of extensive teaching material we have workload of pupils out of multitude of information which again leads to use of mostly frontal form of work and verbal teaching methods. In elementary school, pupils should acquire knowledge and skills as a basis for their further education and professional growth. On the quality content of general education, one should develop skills of pupils needed for this present, modern moment, communication skills, critical and creative opinion.

The problem of pupils' workload should be the focus of educational process reform, as well as one of the starting points in creation of new education policy.

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Augmented Reality and Symbolic-Text Method in an Education of Disabled Children

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Abstract - This paper is focused on augmented reality in projection on real object in association with symbolic-text method for education of disabled children. The main task was to design a system, which would be able to create a sentence from pictures/pictograms/symbols on markers based on detection of markers. The result of the so-formed sentence was image or animation that captured the meaning of the sentence. The output of detection was in the form of projection displayed on a real world object. The projection could be manipulated directly through that real object. For the purpose of an augmented reality has been used ARToolKit framework. For the purpose of visualization and the very logic of the program has been used tool named Blender Game Engine. This tool was also used to create 3D models required for preparation of resulting images and animations that have been used as the output of the projection. The purpose of this system was its potential use for children education, especially disabled children education. This education could be done by correctly composing words into sentences with the understanding of their meaning.

I. INTRODUCTION

Development of software applications for handicapped users can be a challenge, even for experienced user interface designers. The fact that many of the handicapped children read less than ordinary ones makes the development of such software more difficult. They read less, because of limited understanding of words meaning, text length and the amount of abstraction. Many words seem abstract for them; because they lack opportunities to experience (sense) their meaning. In many cases they can read words, but they can't understand their meanings, since the conjugation and declension give the same word different forms. Some children begin school attendance with almost no vocabulary. The education process at primary school should help them to expand their vocabulary. They use specific textbooks, which apply alternative communication means and methods of knowledge acquisition using senses, in particular the sight. A number of drawings is used to explain a meaning of a word as the visual form is usually the best for understanding. Books modified by special methods should help in socialization of handicapped children, who have a disadvantage compared to others, since they can't fully use all of their senses. A specific feature of these books is an extended use of symbols, presenting a new model of education, which can help handicapped children in reading with understanding.

Virtual reality (VR) technologies, mainly user interfaces as part of human-computer interaction (HCI [1]) have more and more influence on our lives. There are solutions and technological possibilities which includes VR in daily activities, entertainment, trainings, industrial improvements, education or rehabilitations. It provides a solid ground for a fundamental change in human-computer interaction in a way that will make the interfaces simpler and more natural for people, including those with handicaps. Although handicapped persons are not the primary target group of virtual-reality technologies and systems, we can see the rising number of implementations of these technologies for their benefit. More detailed description of our previous selected results can be found in [2], [3], [4], [5], [6]. The practical experience of our team has been obtained in cooperation with Pavol Sabadoš special united boarding school in Prešov, Slovakia, which focuses on handicapped children with mental and physical disabilities.

In the rest of the paper we describe an augmented reality and symbolic-text method in an education of disabled children. The system can also help in improvement not only of grammar but also fine motor skills of these children. Augmented reality is used here as experimental novel interface. This system can be utilized for various purposes, not limited to handicapped people.

II. COMMUNICATION, DRAWING, SYMBOLS AND AUGMENTED REALITY

As we said in [6], drawing is a simple and smooth activity, which is used to mark objects, actions, events, relations. It is an equitable way of communicating with other verbal or non-verbal methods, it means of contact between people and it is image designed specially to express a certain idea. Since handicapped children can learn to draw easier than read or write, the drawings can help in vocabulary expansion. The drawings can after the explanation read also children with multiple disabilities or children who don't know the alphabet. Therefore, the drawings are suitable also for healthy children in preschool age. Symbol as a simple drawing can handicapped children understand easier than the written word. This is caused by that drawings could provide extended meaning over speech and reading of them doesn't depend on knowledge of specific language.

Communication using symbols is a specific type of communication using expressions and creating sentences based on drawings. Every word in a sentence is supplemented by symbol. Only upper case printed letters are used. The symbols help handicapped children to obtain feedback of text understanding. Different colors frames are used for individual symbols, with respect to the corresponding word classes as living nouns, other nouns, verbs, adjectives or other word classes (adverbs, numerals, prepositions, conjunctions…). Two same symbols mean plural and a strikethrough symbol is the negative of the original one. Examples of representation of sentences using the symbols can be seen in Figure 1.

Figure 1. Examples of symbolic representation: sentence "Brother is reading" (a), sentence "A girl is giving a present" (b) and cups (c)

Handicapped users are not only users with physical or sensory disabilities but also cognitively impaired ones (e.g. users with learning disabilities or concentration problems) and VR technologies should be primarily used to create a natural user interface with improved accessibility for them [15].

Development of software applications for handicapped users can be a challenge, even for experienced user interface designers [7] [8]. The touch screens interfaces, as input, are very usable at this moment. The main advantages of this type of control are absence of other input peripheral devices, compactness and intuitiveness, low implementation cost and reducing of mental burden of the user [9].

The main goal was to design a system based on augmented reality technology that would display desired visualization on real-world object based on detected markers with symbols. The learning could be done in form of simple assembly of sentences by symbols. The result of composed sentence would be rendered in form of static image or video displayed on real-world object. This visualization would be displayed through the projector. Projection should look like it is right on the real object even during manipulation in real time. Finally, it was necessary to implement this design with the help of hardware like camera for image capture and detection and projector for displaying computer-generated elements.

III. AUGMENTED REALITY SYSTEM SYSTEM

The main problem was to map projection to real world object so it looks like it was a part of it [10]. For this purpose it was necessary to implement some kind of configuration. This configuration would be used to manually map projection to real world object by keyboard. It was also necessary to implement accurate detection, because the real world object could be manipulated.

First part of the system was focused on detection of markers. Detection was implemented in programming language C with the help of ARToolKit framework [11]. Program was detecting predefined symbols of markers that were saved in specific folder. The most important was marker of the real world object of cube. After successful detection of this marker its position and orientation was saved in text file. Position and orientation of the marker was in form of OpenGL transformation matrix [12]. It was important that this marker was initialized with exact width of the real world marker in millimeters for better result. When a marker which represented a word was detected its name was also saved to this file.

All of the detection was handled by calling specific methods from ARToolKit framework such as *arVideoGetImage* and *arDetectMarker*. The first method was used to get one frame of video input. The second method searched for pattern of square

frame and a symbol within this frame in the obtained image. This was done for all of the images in video stream.

When the pattern of square frame was detected it was compared to loaded markers. If those matched, variable visible for this marker was set to True. Also variable which contained transformation matrix was calculated. After detection of visible markers program wrote their names to output file. It was important that this program was running in background during visualization and configuration process.

A. Visualization subsystem

The second part of the final system was visualization. It was done in Blender Game Engine [13], which was a part of 3D modeling tool called Blender. For purpose of program logic the engine uses programming language Python [14]. The main element of visualization was virtual object of cube, which represented real world cube. This subsystem processed a data from detection that were saved in specific text file. It obtained position and orientation of projection cube and applied them to virtual object of cube in 3D scene. A Python script was created for this purpose. It obtained a data from the file every frame and based on them it also created specific texture. This texture represented the meaning of the composed sentence. It was then applied to virtual cube in 3D scene. This 3D scene was projected on the real world object of cube in real time.

In program we created 3 virtual scenes for the purpose of visualization. First one contained objects of main menu. Second and third scene contained objects needed for visualization. Those objects were virtual camera and 3D model of cube.

B. Hardware solution

User had to set camera and projector before the actual software configuration. Basic hardware solution is shown on Figure 2.

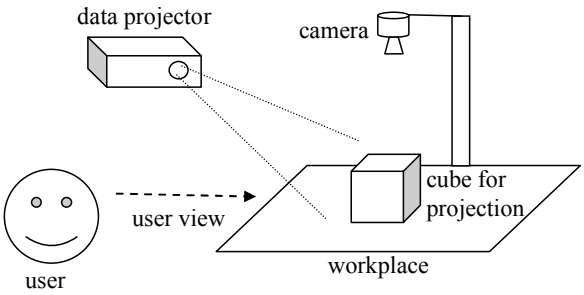

Figure 2. The schema of hardware solution

One of the created scenes was designed for configuration of system. It had implemented keys to control the virtual camera. User could rotate and move the camera by its axis with numpad and arrow keys. Virtual cube had every face in different color and real cube had faces also marked with colors. The goal of configuration was to align those faces so they match together. This configuration was done by manipulating the virtual camera and trying to match its position and orientation with real world projector. The successfulness of this process depended on good observation skills of user.

The image above contains real cube in the final phase of configuration. Colored faces are positioned so they look like a part of the cube. Side with the marker for detection had to be aligned with white side of the virtual cube for better detection results. During configuration we encountered a problem with detection when projection overlaid marker. In this case projection started to flicker, so it was hard to configure system that way. This problem was solved by adding Enter key to turn detection off and on. While it was turned off user was not allowed to move camera, projector or even the cube. After successful configuration user could turn detection on and check the results by observing the cube. If user was satisfied with the result he could save configuration to a file for later use. It was very important that user didn't move with camera or projector after saving configuration. If that happened user could load configuration file and make adjustments and then save it again.

C. Composition of Sentences From Symbols

After successful configuration user could start system for composition of sentences. In that case user interaction with system was done by manipulation of the cube and paper markers with pictures. In final phase projection on cube was representing the meaning of composed sentence. Example of such composition is displayed at Figure 3.

Figure 3. Example of composition of sentence

On the image we can see 3 markers with symbols of fish, swimming and water. Those markers are composed into sentence *Fish is swimming in water*. The meaning of this sentence is displayed on projection cube as animation of swimming fish on blue background. Each side of the cube contains view from different side.

When user manipulates with the cube it look like the projection is a part of it, because it also changes (Figure 4). This was possible because of detection of marker and by applying its transformation on virtual cube. Processing of detection data was done in Python script. This script was connected to object of virtual camera via logic brick that is part of Blender Game Engine. Method for processing detection data was called every frame.

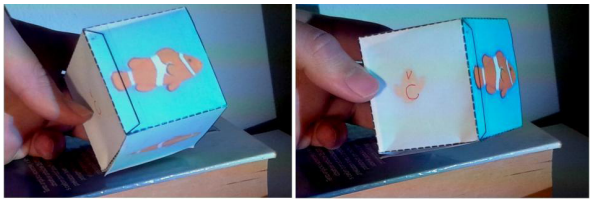

Figure 4. Manipulation with projection cube

This image is showing how real cube looked during manipulation. This result could be achieved only if process of configuration was done correctly and accurately. We could see that faces of real cube contained different views of final visualization specifically right, back and bottom views.

D. Remarks to solution

For the purpose of a demonstration of the system it was designed as a support system for children education, especially handicapped children education. The contribution of this paper was its design of the system which connected elements of augmented reality with projection on real world objects. Such system had a lot of potential in usage as support system in learning, playing games or in presentation of products. By connecting augmented reality and projection user could experience different interaction with system than he was used to.

The most difficult part of the system was configuration of projection. It was designed so it can be done manually by observing real object and projection. This process should be easier. Simplification could be done by displaying marker with projector and detecting this marker by camera. System could calculate difference between camera and projector and based on results set transformation of virtual camera.

IV. CONCLUSION

Working with handicapped children in cooperation with Pavol Sabadoš special united boarding school in Prešov proved to be two-beneficial. The first benefit is the popular character, where children have a real experience with VR and the second benefit shows the research potential. The modification of user interface using augmented reality technology creates a new possibility of interaction, it opens up opportunities to work with handicapped children. The technologies like virtual reality or mixed reality have the greatest progress nowadays. They allow the creation of previously impossible procedures. These procedures especially their visual aspect and interactivity may change streamline and shorten the process of interaction between humans and computers.

Our further work in this area will be focused to improve experiences with augmented reality technology. As is shown in Figure 5 (example from pilot project), next steps are in mixing of symbols and virtual 3D object at the same place of touch screen and, of course, in real time. The child can to manipulate with virtual 3D object. This object is an extension of 2D symbol used in present day. It is new way in the vision of "Learning by playing".

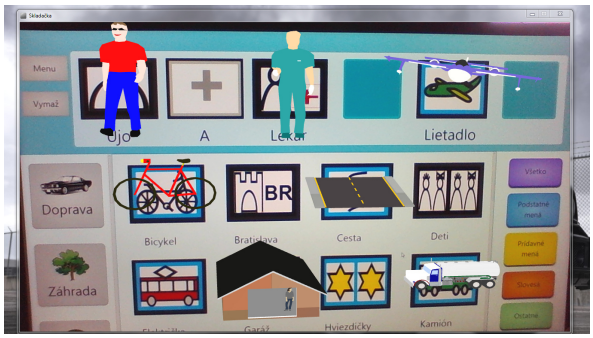

Figure 5. Example of workplace with symbols and 3D virtual objects using augmented reality

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Wave equation with Dirichlet boundary conditions

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Abstract - Partial differential equations derived from relationship between different physical and geometric problems where the function depends on two or more independent variables. Hyperbolic equations are a type of partial differential equations. In this paper, we consider the wave equation as a special form of hyperbolic equations. In addition, we are using computer simulation of the wave propagation on a specific numerical model occurring due to Dirichlet boundary conditions. We used formulation of the wave equation via the velocities, strains, and stresses. For simulation, we are using FORTRAN programming language.

I. INTRODUCTION

Most of the physical problems (heat transfer, electromagnetic theory, quantum mechanics, etc.) are resolved by application of partial differential equations. Partial differential equations derived from relationship between different physical and geometric problems where the function depends on two or more independent variables, most of the time t and of one or more spatial variables.

These equations can be divided into three groups:

- Elliptical (Laplace equation)
- Parabolic (heat equation)
- Hyperbolic (wave equation)

The solutions for each type of equation vary and therefore additional conditions are considered for solving each type of equation. Additional conditions are initial conditions (at time t=0) or boundary conditions (prescribed values of the solution u or some of its derivatives on the boundary surface S, or boundary curve C, of the region) or both. For one and two dimensional wave equation there are two initial conditions (initial displacement and initial velocity).

In this paper, we will focus on numerically solving of problems by applying one-dimensional wave equation as a special form of hyperbolic equation.

II. WAVE EQUATION

As a first important hyperbolic partial differential equation, we will consider the equation which is used for small transverse vibrations of an elastic string, such as a violin string. We place the string, parallel on the x – axis strained along length L, and fastened at the ends x = 0 and x = L. Next, we are distorting the string and at some moment of time (for example when t = 0), we releasing it and it starts to vibrate. Our purpose will be to determine the vibrations of the string and finding its deflection u(x,t) at any point x and at any time t > 0 (Fig.1).

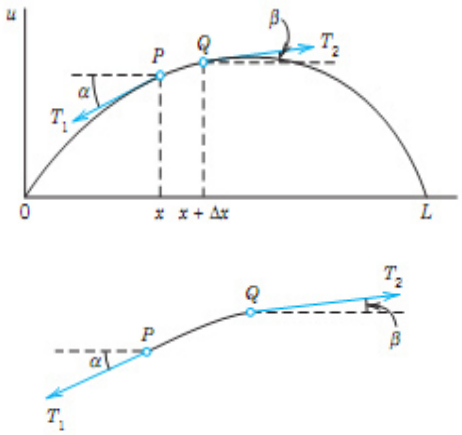


Figure 1. Deflected string at fixed time t (redrawn from Kreyszig, 1999)

In fact, u(x,t) will be a solution of the partial differential equation. For this equation to be solved the following assumptions are made:

- The mass of the string per unit length is constant. The wire is perfectly elastic and it makes no resistance during modifications.
- The tension caused by stretching of the string before its fastened at the ends is so large that

the action of the gravitational force on the string can be neglected.

- The string makes small transversal movements in a vertical plane. Each particle of the string is moving only vertically, causing a deflection and the slope at every point of the string is always small.

To derive a differential equation, we take into consideration the forces which act on a small portion of the string (Fig. 1). Because the string doesn't offering resistance to bending, the force of tightening is the tangent to the curve of the string at each point. Let T_1 and T_2 be the forces of tightening at the ends points P and Q. Because, the points of the string are move vertically, there aren't movements in the horizontal direction. Therefore, the horizontal components of the forces of tightening must be constant. By using the notation from Fig. 1, we obtain:

$$T_1 \cos\alpha = T_2 \cos\beta = T = const \quad (1)$$

In vertical direction there are two forces, called vertical components $-T_1 \sin\alpha$ and $T_2 \sin\beta$ for T_1 and T_2. The minus sign appear because the component at P is directed downward. By Newton's second law, the result of these two forces is equal to the mass $\rho\Delta x$ of the portion multiplied by acceleration $\frac{\partial^2 u}{\partial t^2}$, evaluated at some point between x and $x + \Delta x$, where ρ is the mass of the string which is not deviated per unit length and Δx is the length of the string which is not deviated . Hence:

$$T_2 \sin\beta - T_1 \sin\alpha = \rho\Delta x \frac{\partial^2 u}{\partial t^2}$$

By using (1), we can divide this with $T_2 \cos\beta - T_1 \cos\alpha - T$ and then obtain:

$$\frac{T_2 \sin\beta}{T_2 \cos\beta} - \frac{T_1 \sin\alpha}{T_1 \cos\alpha} = \tan\beta - \tan\alpha = \frac{\rho\Delta x}{T}\frac{\partial^2 u}{\partial t^2} \quad (2)$$

Tan α и tan β are slopes of the string at x and at $x + \Delta x$

$$\tan\alpha = \left(\frac{\partial u}{\partial x}\right)\Big|_x \quad \text{and} \quad \tan\beta = \left(\frac{\partial u}{\partial x}\right)\Big|_{x+\Delta x}.$$

By using the partial derivations of the u(x,t) and by dividing of (2) with Δx, we thus have:

$$\frac{1}{\Delta x}\left[\left(\frac{\partial u}{\partial x}\right)\Big|_{x+\Delta x} - \left(\frac{\partial u}{\partial x}\right)\Big|_x\right] = \frac{\rho}{T}\frac{\partial^2 u}{\partial t^2}$$

For Δx→0, we obtain a linear partial differential equation

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}, c^2 = \frac{T}{\rho} \quad (3)$$

This equation is one dimensional wave equation (1D) which is solution of our problem. 1D equation means that equation includes only one spatial variable x.

III. THE MODEL

A 1D Wave equation is represented with equation (4)

$$\rho\frac{\partial^2 u}{\partial t^2} = \frac{\partial \sigma}{\partial x} \quad (4)$$

For establishing this equation we need to define the velocity of propagation of the wave $\beta = \sqrt{\frac{\mu}{\rho}}$

where μ is shear modulus of the material, and ρ is density of the material from which the rod is made. The parameters ρ and μ are different and specific for each material from which the rod is made. $\sigma = \mu\varepsilon$ is shear stress and ε is shear strain of the wave.

For establishing the iterative procedure, the equation (4) is presented as the first order system of partial differential equations through the velocity of movement v and through strain ε.

By replacing $v = \frac{\partial u}{\partial t}$ for the velocity in equation (4), we get:

$$\frac{\partial v}{\partial t} = \frac{1}{\rho}\frac{\partial}{\partial x}(\mu\varepsilon) = \frac{\mu}{\rho}\frac{\partial \varepsilon}{\partial x} \quad (5\ a)$$

Then, if the both sides of identity $\frac{\partial u}{\partial t} = \frac{\partial u}{\partial t}$ are differentiated with respect to x, we obtain $\frac{\partial^2 u}{\partial t \partial x} = \frac{\partial^2 u}{\partial t \partial x}$. By replacing ε with $\varepsilon = \frac{\partial u}{\partial x}$ in the last equation, we then get the equation 5b:

$$\frac{\partial \varepsilon}{\partial t} = \frac{\partial v}{\partial x} \quad (5\ b)$$

The equations 5a and 5b can be presented as vectors as follow:

$$\{U\}_t = \{F\}_x \text{ or } \frac{\partial U}{\partial t} = \frac{\partial F}{\partial x} \text{ where } U = \begin{Bmatrix} V \\ \varepsilon \end{Bmatrix} \text{ and}$$

$$F - \begin{Bmatrix} \frac{\mu\varepsilon}{\rho} \\ V \end{Bmatrix} - \begin{Bmatrix} \frac{\sigma}{\rho} \\ V \end{Bmatrix}$$

The vector U at point i and time (j+1)Δt is

$$U_{i,j+1} = U_{i,j} + \Delta t\left(\frac{\partial U}{\partial t}\right)_{i,j} + \frac{\Delta t^2}{2}\left(\frac{\partial^2 U}{\partial t^2}\right)_{i,j} + \cdots$$

By replacing $\frac{\partial U}{\partial t}$ with $\frac{\partial F}{\partial x}$, we obtain

$$U_{i,j+1} = U_{i,j} + \Delta t\left(\frac{\partial F}{\partial x}\right)_{i,j} + \frac{\Delta t^2}{2}\frac{\partial}{\partial t}\left(\frac{\partial F}{\partial x}\right)_{i,j} + \cdots$$

We can write the part $\frac{\partial}{\partial t}\left(\frac{\partial F}{\partial x}\right)$, as $\frac{\partial}{\partial x}\left(\frac{\partial F}{\partial t}\right)$ where $\frac{\partial F}{\partial t} = \frac{\partial F}{\partial u}\frac{\partial u}{\partial t} = A(U) * \frac{\partial U}{\partial t}$ or

$$A(U) = \frac{\partial F}{\partial U} = \begin{bmatrix} \frac{\partial \sigma}{\rho \hat{c} v} & \frac{\partial \sigma}{\rho \partial \varepsilon} \\ \frac{\partial v}{\partial v} & \frac{\partial v}{\partial \varepsilon} \end{bmatrix} = \begin{bmatrix} 0 & \frac{\partial \sigma}{\rho \partial \varepsilon} \\ 1 & 0 \end{bmatrix}$$

In A(U), $\frac{\partial \sigma}{\rho \hat{c} v} = 0$ and $\frac{\partial v}{\partial \varepsilon} = 0$ because σ does not is depended of v.

Hence, for $U_{i,j+1}$, we obtain

$$U_{i,j+1} = U_{i,j} + \Delta t\left(\frac{\partial F}{\partial x}\right)_{i,j} + \frac{\Delta t^2}{2}\frac{\partial}{\partial x}\left(A(U) * \frac{\partial F}{\partial x}\right)_{i,j} + \cdots$$

For incident excitation in our example, we take a semi - sine pulse (Fig.2). U_{0max} presents the amplitude, and t_d is duration of the pulse.

$$U_o = \begin{cases} A * \sin\frac{\pi t}{t_d}, t \le t_d & (6a) \\ 0, \quad t > t_d & (6б) \end{cases}.$$

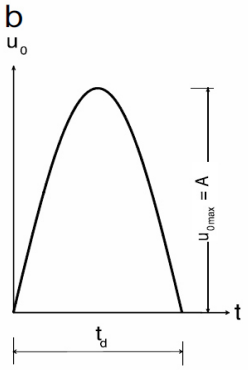


Figure 2. Incident excitation

Our problem is with wave equation to calculate the displacement at each point x during the each time t in 1D medium-rod. The rod is divided into 200 equal spatial intervals. By every displacement, the rod is vibrating. At every point, we calculate the final central difference with the formulas (7) and (8).

$$\frac{\partial^2 u}{\partial x^2}(x_i, t_l) \approx \frac{u_{i-1}^l - 2u_i^l + u_{i+1}^l}{\Delta x^2} \qquad (7)$$

and $$\frac{\partial^2 u}{\partial t^2}(x_i, t_l) \approx \frac{u_i^{l-1} - 2u_i^l + u_i^{l+1}}{\Delta t^2} \qquad (8)$$

where $x_i = (i-1)\Delta x, i = 1, \ldots, n$ and $x_l = l\Delta t, l = 0.1 \ldots$

IV. The Results

The velocity of propagation of the wave is $\beta = 300$ m/s, the amplitude is A=0.1m and the duration of the pulse is t_d=0.1s.

The displacement as a function of x is obtained from (6a) as

$$u = A\sin\frac{\pi t\beta}{t_d\beta} = A\sin\frac{\pi x}{t_d\beta} \qquad (9)$$

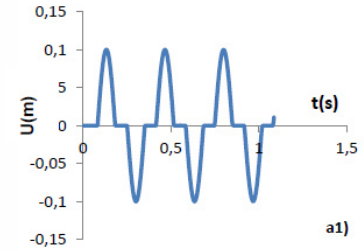
By differentiating equation (9) with respect to x, we obtain

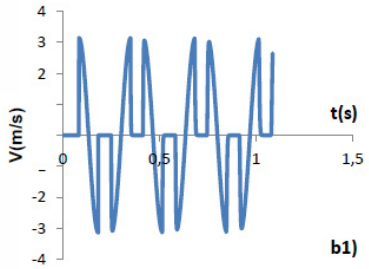
$$\frac{\partial u}{\partial x} = \frac{\pi A}{\beta t_d}\cos\frac{\pi x}{t_d\beta} \qquad (9a)$$

So, for the maximum value of the strain ε, we have

$$\varepsilon = \frac{\pi \cdot 0.1}{300 \cdot 0.1} \sim 0.01.$$

We solved this problem by using FORTRAN as programming language. In Fig. 3 are presented the results of the numerical simulation of spreading of the wave in the form of semi - sine pulse at the middle point $x = \frac{n}{2}$ opposite the time for $\beta = 300\ m/s$.





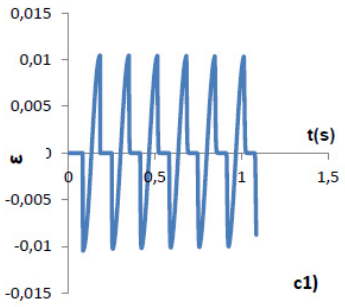


Figure 3. Graphical representation of the solution (displacement, velocity and strain) at the point on the middle of the beam, x = H/2 versus time

In Fig.3 a graphic representation of the solution at the middle point of the rod when we have point 100 and x = H / 2 or 25m is given. The displacement u, the velocity v and the strain ε in depend of time t are shown. The graphic representation is given for fixed ends when U=0 at the bottom, x=0 and at the top x = H = 50 m (Dirichlet boundary conditions). In this case when we have the fixed boundaries after the reflection, the pulse changes the sign and in the middle of the rod (in the point 100) comes with opposite (negative) displacement compared to the first pass through this point (the second peak in Fig. 3a1 is with negative sign). The situation is identical also for the velocity (Fig. 3b1). In contrast to the velocity and the displacement, the strain after reflection does not change the sign i.e all the semi-cosine waves (Fig. 3C1) begin with negative sign and finish with positive sign.

So when we have fixed ends (Dirichlet boundary conditions), after the reflection the sign of displacement u and the velocity v changes, but the sign of strain ε does not change. After several reflections, the amplitudes of the pulse remain unchanged.

V. CONCLUSION

For values $0 \leq r* \leq 1$ for the parameter r, this model will be stable, so from the equation (6) we can expect an acceptable result for the discontinuities initial data. In addition, we can conclude that for fixed ends such as Dirichlet boundary conditions like in our example after reflection sign of displacement, u and velocity, v changes, while the sign of strain, ε does not change.

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Prerequisites for Dual Education in Engineering

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Abstract – The report discusses some problems leading to a serious deficit in engineering and technical staff for Bulgarian industry and options for change, leading to increased interest of young people to engineering education and strengthen the link between universities and business. Analyzed a model of duality education and opportunities for adaptation the model to preparing engineers with higher technical education. In the report are formulated some basic problems and tasks to solve introducing duality education for training engineers.

I. INTRODUCTION

We are witnessing serious problems training the engineering specialists in Bulgaria. On one hand, the number of universities is too large, and secondly the number of candidate students is too low. Despite the fact that last year the government determine the so-called "priority professional fields," the number of vacancies in engineering specialties was again high.

Engineering specialties are unattractive and input them is lower scores on entrance exams and high school diploma. Meanwhile, business firms and chambers of commerce are constantly looking for engineers. Secondary vocational education as a natural university donor for training of specialists in engineering is nearing to collapse. Many professional technical secondary schools in the country are enclosed.

Bulgarian Industrial Association alarms for the worrying situation of vocational education by preparing justified report to the Ministry of Education. The report stresses deteriorated content and quality of vocational education and serious reduction from the young people, inefficient a career orientation system and a deficit of teachers with adequate modern technological development competencies [6].

The concern of a Bulgarian economic chamber about the unsatisfactory state of vocational education is based on the fact that more than 65% of the members of the Chamber complain about the lack of staff with the necessary qualifications and skills. Blagoevgrad is one of the regions with the most acute shortage of engineering personnel. In its opinion is an assessment and the reasons leading to shortage of engineers in the country. It considered that the main reason lies in the "Discrepancy between the competences of graduates and the needs of the labor market. Absence of a link between training content (curricula), the labor market and practice. Need for practical training of students in a real work environment. Insufficient career orientation of graduates "[8].

Considering the gravity of the current situation taken real and effective measures at national level to adopt changes in vocational education. The Law on Vocational Education has amended, and since September 2016, the country has trained in 19 vocational high schools under the dual system. The introduction of the dual learning system into the Bulgarian educational system aims to better connect the educational system, the students and the business. Parallel to the study of the theory of a given profession, students can apply the theoretical knowledge acquired in a real working environment, in the partner company of the school. The difference with the current professional training in Bulgaria is that companies can initiate the creation of classes in specialties where they experience shortages of workers. Therefore, companies invest directly in the personnel they need. Specialists from companies can participate in the preparation of curricula, examination programs to mentor students or students in the workplace. Teachers of professional disciplines trained in the latest technologies used and applying in the relevant partner companies.

The introduction of the dual form of education expected to increase the quality of vocational training by sharing responsibility between companies and schools.

The analysis made above the status of duality education in Bulgaria shows that the foundations laid of duality vocational secondary education. This will significantly increase interest in engineering disciplines, and will enhance the role of employers in the preparation of the necessary labor market specialists. In our country, there is no published and discussed practical implementation experience with the introduction of duality

education system of the higher education. Therefore, the objective of this work is to analyze model of duality education and its ability to adapt in the training of engineers with higher engineering education.

II. DUAL EDUCATION

A. *Characteristics of the Duality Education*

Dual education is a type of vocational training that takes place in parallel in two places - at a vocational school or university and business [5, 7, 9, 10, 11]. The term "dual education" has widely used as a term, because teaching and learning characterized by "a duality in terms of:

- Duality of places of learning (school / company) and duality in sharing the responsibility for providing theoretical and practical training;
- Duality of participants (public and private entities) in share responsibility for policy and the quality of vocational training and practice.

Dual system is a specific model for vocational training, which focuses on the practical absorption of profession through work. School time in the dual system integrated between theoretical training at a vocational school and work in a company (Figure 1).

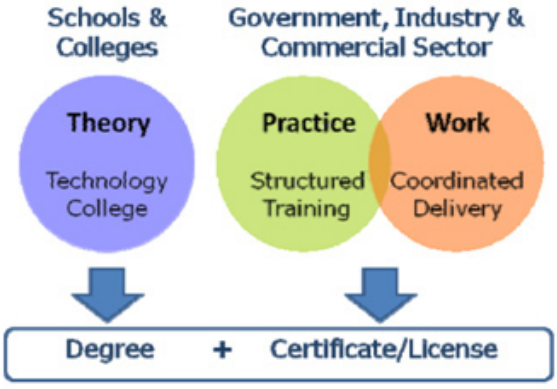

Figure 1. Model of dual education system [11]

The introduction of dual training model eliminates the problem of lack of experience, which is necessary for young people to find work in the desired profession immediately after graduation. Companies save cost and time to train newly appointed employees.

The advantages of the dual system demonstrated most convincingly by the statistics on youth and total unemployment in the EU. Figure 2 displayed results of the research [1], on the relationship between youth unemployment and the level of development of vocational education.

The research categorically demonstrated the relation between the lowest unemployment and dual education in the countries. Thanks to this model of vocational education and training rate of youth unemployment in Austria and Germany is the lowest, as opposed to all other countries in the European Union.

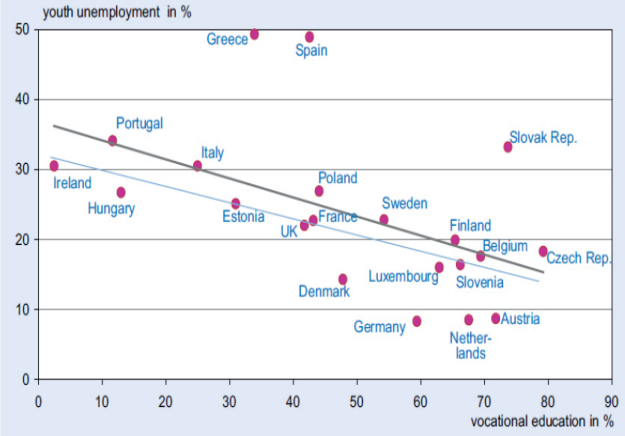

Figure 2. Relation between youth unemployment and vocational education [1]

B. *Dual System of Higher Education*

Dual higher education is a form of dual education with the difference that the theoretical part teach at the university. A pioneer in higher education duality is German state of Baden-Württemberg, which in 2009 brings together all professional academies province in dual University School of Baden Württemberg (Duale Hochschule Baden Württemberg (DHBW)) [7].

With the founding of government DHBW graduates of dual specialty receive academic diploma internationally recognized Bachelor degree. Currently, in all provinces of Germany has dual degree that offer effective link between periods of practical training in companies and periods of theoretical training in universities.

It is necessary to note that the German dual system students receive salary for the period of practical training in companies. This makes independent students during their studies, removes excess stress along the job search to finance their education. Financial support throughout the study (both during the practical phase and during the theoretical) allows students to concentrate on studies without having to worry about money, part-time jobs or scholarships.

III. MODELS OF DUAL EDUCATION

A. Factors Influencing Model of Dual Education

The factors that influence the models of dual education are: [5]:

- Statute of students during their studies - apprenticeship or employment contract. Three main types of contracts: specific apprenticeship contracts, employment contracts and learning or training contracts (or Learning Agreements);
- Receive a salary or an agreement between the student, employer and university - Apprenticeship contracts stipulate the specific rights for apprentices that may be different from those of regular employees. Typically, the minimum remuneration is lower than that of regular employees. These contracts also specify other entitlements in comparison to those of employees. The employment contracts they are a form of employment contract that enables employers to pay fewer contributions, to pay lower wages or have more flexibility regarding certain other protections. These contracts are typically only open to young people between 16 and 25. National laws or sectorial collective agreements generally regulate learning Agreements and apprenticeship contracts.
- Different schemes of alternating theoretical learning and practical learning through work

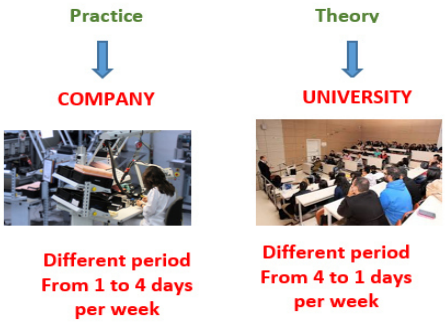

Figure 3. Examples scheme for dual education

The analysis of the curricula of different universities shows that there are different schemes of alternating theoretical with practical training. For example, the student can work 2-3 days in the company, and then to learn another 2-3 theoretical matter in his higher school. Good communication between employers and universities allows the two processes are complementary. Under this option, the student graduated, holding only a thesis or state exams. The second option implies a greater dividing between university and work. For example, one whole semester at the higher school, followed by one semester of work experience. In this case, the student takes exams both at the university and at the industrial and commercial chamber German (IHK). The student does not always have the choice of how to study. This depends both on the higher school and on the program chosen. In both cases, however, the firm assigned a mentor who helps apprenticeship to enter the program and report its results and faced problems.

- Duration of apprenticeships. analysis of the duration of apprenticeship in eight European Union countries shows that there are differences:
  - duration fixed for all apprenticeships (Greece);
  - duration fixed, but depending of the qualification or type of diploma (France, Germany, Italy, Poland, the Netherlands);
  - flexible duration (England, Finland);
  - Different conditions for admission to the university. These conditions create a certain barrier to entry because not all young people have career management competences and need support or additional training.

C. Models of Duality Higher Education [5]

First model: Fully-fledged apprenticeships, is a dual education model in which (fig.4) :

- Trainees are part of formal education and receive a nationally recognized certificate and qualifications;
- The content of training in companies jointly determined by governments of states, representatives of employers' organizations, trade unions;

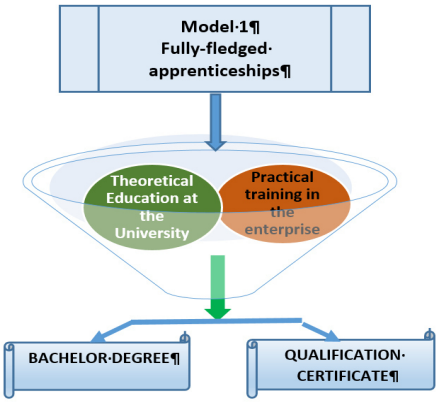

Figure 4. Model of Fully-fledged apprenticeships

- Trainees have a clear status, receive payment and have clear rights and obligations for all involved parties (apprenticeship, company, training center, etc.).
- Training costs shared between government and employers.

Second model: Apprenticeships as a parallel track to other forms for vocational training in university. This model combines internships with practical training and education at the university (fig.5). Traineeships support training in universities. Upon graduation, students receive a bachelor's degree. Certain universities also receive qualification certificates.

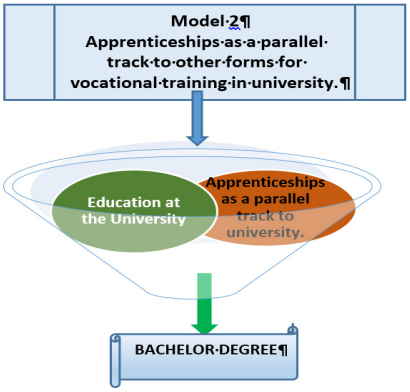

Figure 5. Model of apprenticeships as a parallel track

Third model: Strong elements of work-based learning in university based programs (fig.6)

Training at the University remains the basic form of training of engineers, but work based learning systematically integrated in the curricula of university courses [2, 3, 4]. The periods of training in companies defined in the curriculum and compulsory for students. Students have practical training in different companies, enabling them to gain experience in different workplaces and business environments.

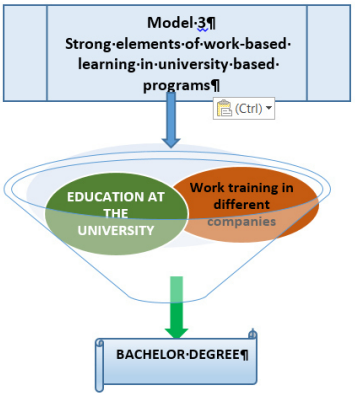

Figure 6. Model of Strong elements of work-based learning in university based programs

Fourth model: Dual education parallel to company work (fig.7)

This educational model conceived like "normal" part-time training, as it usually completed in parallel while the person is working full-time. It differs from normal part-time training in that the employer is also involved in the form of training but by dismissing him from work during the formal phases of the training.

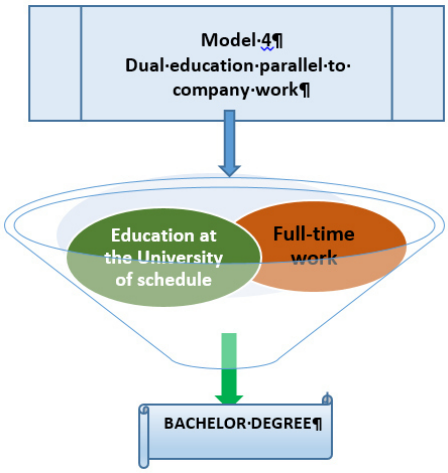

Figure 7. Model of dual education parallel to company work

Fifth model: Fully university-based engineering education

This model is typical of Bulgaria as well as EU countries that are at the earliest stages of integrating learning into the university and working in a company. In most cases, training takes place in universities. This is the typical model for Bulgarian engineering education, which leads to a number of challenges such as:

- Lack of cooperation between universities and companies or, if there is collaboration, it is formal, not effective;
- Lack of understanding of employers for apprenticeships and similar forms of training.
- Employers are not prepared to train young people to get a full qualification in the profession (not just for company-specific skills);
- Problems related to obsolete curricula, university equipment, and teacher competencies.

III. DISCISSION AND CONCLUSION

Dual education is a proven and successful form of engineering training. Different models of dual education apply, each with its specificity, advantages and disadvantages. The introduction of dual education into the educational systems of the different countries of the European Union leads to a reduction in youth unemployment. Graduates engineers receive the necessary practical knowledge and skills and can immediately start work. The problem of the need for practical job search experience eliminated.

Dual education also has some disadvantages such as:

- Poor research work, almost lacking preparation for research. Not suitable for cadres who have an affinity in the field of science and research;
- High workload. Dual education is not very suitable for people with low endurance loads. By constantly changing periods of practical training (during which even work should be done outside of attending a vocational school) and lectures (at the end of which examinations are required), a dual education is very often very intense. Moreover, during the summer and summer during the summer vacation cannot be rest, because there is no semester holiday.
- Interruption of dual education is almost impossible. Anyone who has once chosen a dual form of education should end it. Of course, somebody may not be happy with his professional and educational choices, or he may not like it at all. Then the interruption of education makes sense, only in this case (the former) employer may require the reimbursement of the paid student fees to be paid. These financial condition forces students in dual learning to complete their education, even though they realize they have made the wrong decision, and walking every day for them is a torture.

Establishing, targeting one job. In the dual form of learning from the very beginning, the student concentrates only on one practical specialization.

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A GIS Based Approach for Hydrological Conflicts Estimation

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Abstract - Most of the problems that the world faces today - environmental, economic, political, social problems – they all exist in a geographical sense. Identification of geographical component as important determinants of decision making initiated the new approach to management – managing geographically. Geospatial data visualization listed Geographical Information System (GIS) as an integral information system for decision making, more efficient and less expensive way to monitor all social and environmental trends. With GIS, students and education community are able to expand their knowledge trough geospatial data analysis and prepared to meet the demands of today's social development whether they are involved in business, government or science.

In order to show the importance of GIS use in spatial planning at the local and regional level a case study was done. Hydrological conflicts are estimated as potential risks that may occur due to water consumption in water supply (agricultural, industrial and population use) at the regional level of Vojvodina, due to lack of water during dry periods. Conflict zones were identified and created risk maps using GIS tools and databases on the estimated water consumption.

I. INTRODUCTION

Psychological research and theory suggests that by having students learn through the experience of solving problems, they can learn both content and thinking strategies. [1] This finding led to the development of lecturing methods. Problem Based Learning (PBL) and Inquery Based Learning (IBL) are instructional methods which are based to constructivism and represent a shift from a behaviorist to constructional approach in learning. PBL is well suited to helping students become active learners because it situates learning in real-world problems and makes students responsible for their learning. [2] It has a dual emphasis on helping learners develop strategies and construct knowledge.[2] Students engaged in IBL develop content knowledge and learn increasingly important twenty-first century skills, such as the ability to work in teams, solve complex problems, and to apply knowledge gained through one lesson or task to other circumstances.[3] Student is no longer just a passive recipient of information and he is encouraged to use IT technology and internet to seek information outside the conventional framework.

However, internet use in research process brought new problems. We become overwhelmed with an abundance of data that created new problems regarding scientific work. Research and analysis of the enormous amount of data has become increasingly difficult in terms of recognition the necessary from unnecessary data. Finding the needed data and obtaining the necessary information became challenge for the scientific community. Consequently, visualization emerged as a possible solution.

Process of visualizing data is a cognitive activity with which people build mental models of data, or rather an internal representation of the world around them, from which they manage to expand on and understand such data. [4] Today, computers can make the process of visualization much easier if we use some of the visualization tools, but actual visualization is indeed activity which happens in our mind, and it is essential for understanding the data.

Bringing together visualization and spatial analysis, Geographical Information Systems (GIS) were created and became essential in PBL and IBL for students interested in various fields of science. GIS is a catalyst for research and students in universities throughout the world. Being multidisciplinary, geospatial technology gives students the skills they need for success in further education or their chosen discipline.

As GIS is based on spatial information, the most visible use of GIS is in geography and environmental studies. Hence, becoming proficient with GIS skills is mandatory for students who are

interested in environmental sciences and risk management.

In order to present GIS use in environmental protection and planning in the following text will be presented results of the research done on estimation of hydrological conflicts that may occur on the territory of Vojvodina in case of water shortage.

To identify a potential conflict zone, water consumption data and water availability data are put into the spatial context and risk maps are created.

II. WATER CONFLICTS BACKGROUND

Vojvodina belongs to Köppen – Cf (warm moderate climate, with even distribution of precipitation during the year) or Trewartha - D.1 (continental climate with longer warm season) climate zone. Natural characteristics of a continental climate are high fluctuations of water balance. In the Panonian Basin average rainfall in the last 80 years is 530-560 mm. However, these values represent only a statistical average, while in most years observed rainfall values deviate significantly from the average.

An increasing trend of annual mean temperature can be observed in Vojvodina based on data of the past 65 years. The period of 1951-2016 can be characterized by the temperature rise of 1°C on average.

The groundwater reserves of the blown sand area in the Danube – Tisza interfluve can only be refilled from precipitation. Consequently, groundwater level significantly decreased after the 1970s, probably mainly caused by climatic reasons.

All this clearly shows that the special environmental conditions of the region by itself can cause extremes in water supply in Vojvodina. Beside the natural causes, human effects also contribute to extremes in water supply. The appearance of hydrological conflict between end users of groundwater resources can be expected.

Demographic movements and tendencies of economy development directly reflect on the needs for water. For the regions with unequal internal development, migrations from less developed municipalities to more developed ones are characteristic. Development of urban centres leads to increased concentration of population in their vicinity. Tendency of high migrations to developed urban centres leads to demographic depletion of rural settlements [5]. Demographic movements and tendencies of economy development directly reflect on the needs for water. Accordingly, it is necessary to overview disposable water capacities of Vojvodina.

Due to limited availability of surface waters, the whole population and majority of industry and wildlife are oriented exclusively to groundwater capacities. The term groundwater includes all water contained beneath the Earth's surface. However, in water management only the part of groundwater that can be reached and used is considered to be a water resource. The shallow aquifer in Vojvodina is usually called the first aquifer. Over the whole area of Vojvodina, below the first or the phreatic aquifer, lies the deep groundwater. This is the name for all pressurized groundwater, whether they are artesian waters, where the water pressure is positive, ie. above the terrain, or sub-artesian, where the water pressure is negative, ie. below the surface.

For technical users, Danube-Tisa-Danube system was developed as a network of surface water streams. The largest user of surface water in Vojvodina is agriculture. Due to limited availability of surface waters and low water quality, the whole population and majority of industry and wildlife are oriented exclusively to groundwater capacities. However, reserves of quality water from artesian wells are decreasing in some parts of Vojvodina, because exploitation exceeds reserves, and renewal cycle is relatively slow. [6]

Around 65% of estimated capacities of groundwater come from alluvial aquifers, which relativize their availability in dry periods. [7] Due to over-exploitation groundwater, some parts of Vojvodina (Bačka and Banat) have seen a significant decrease in level of ground waters in basic water-supply complex (up to 50 meters in some parts). [7]

III. HYDROLOGICAL CONFLICTS ESTIMATION

For purposes of detecting conflicts related to water management in Vojvodina, characteristic loads of water consumption and thickness of water-supply layers in the zone of individual loads have been analysed. As indicators of water resource loads, average household consumption, average public consumption, industrial consumption, cattle-breeding consumption and agriculture consumption have been recognized. For spatial representation and data analyses, QGIS software was used.

Above mentioned consumption is calculated on the basis of consumption norms [7], which determine necessary capacity of water supply system. Norms are determined on the basis of real data on water consumption in a given area. For

calculation are used data from Statistical Office of the Republic of Serbia. [8] [9]

Water consumption in households is personal consumption for physiological, hygienic and sanitary needs. It varies depending on number of inhabitants in a settlement. Calculated daily consumption for household use in Vojvodina is 260.875 m^3/day.

Public consumption is water consumption, which comes from activities in a specific settlement area (public institutions, hospitals, schools, businesses, etc.). Calculated daily consumption for public use in Vojvodina is 32.709 m^3/day.

Industrial consumption is related to water needs in industry. Water consumption in this sector, mostly depends on a settlement size. Estimated daily consumption for industry use in Vojvodina is 45.115 m^3/day.

Water consumption in cattle-breeding is related to the daily needs of farm animals. Based on consumption norms, calculated daily consumption for cattle-breeding in Vojvodina is 38.828 m^3/day.

Agriculture water consumption implies on water consumption for irrigation use. To estimate the consumption of water for irrigation purpose the assumed rate of irrigation is 0.5 l/s per hectare and the irrigated period is three months a year (June, July and August). Total estimated amount of water consumed for irrigation in Vojvodina equals 226.479.927 m^3/year, of which 101.689.487 m^3/year are groundwater.

Previously calculated parameters provide us with information on the total estimated amount of water consumed from groundwater sources. However, these parameters properly describe water consumption only if they appear in a spatial context and on a single, common composition. Visualizing water consumption, it is quick and easy to notice municipalities which consume the groundwater the most and the type of consumption that leads in total consumption.

The largest consumption of water from aquifers can be noticed in the irrigation segment, followed by water consumption needs of the population. (Fig. 1) Therefore, in territories with the highest observed consumption, water conflicts may arise among consumers (Zrenjanin, Bečej, Vrbas, Kula, B. Palanka). Conflicts are possible during the vegetation period, mostly during the irrigation period. Since higher consumption of water for irrigation, and reduced groundwater levels due to over-exploitation are expected in the future, this kind of conflict is inevitable.

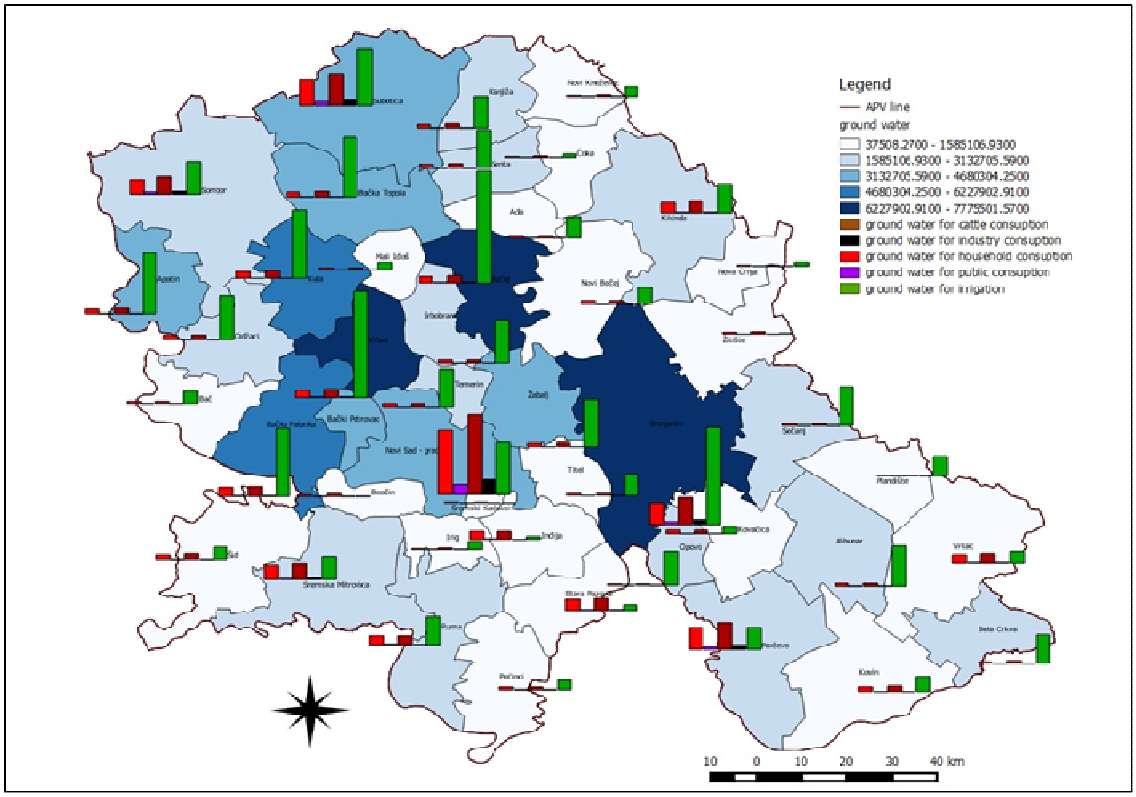

Figure 1. Total consumption from groundwater sources (m3/day)

Thickness of water-supply layers, available to Vojvodina, are sorted into 5 categories: less than 20 m, 20-35m, 35-50m, 50-100m and more than 100m. Figure 2 shows the spatial distribution of individual thicknesses of water-supply layers.

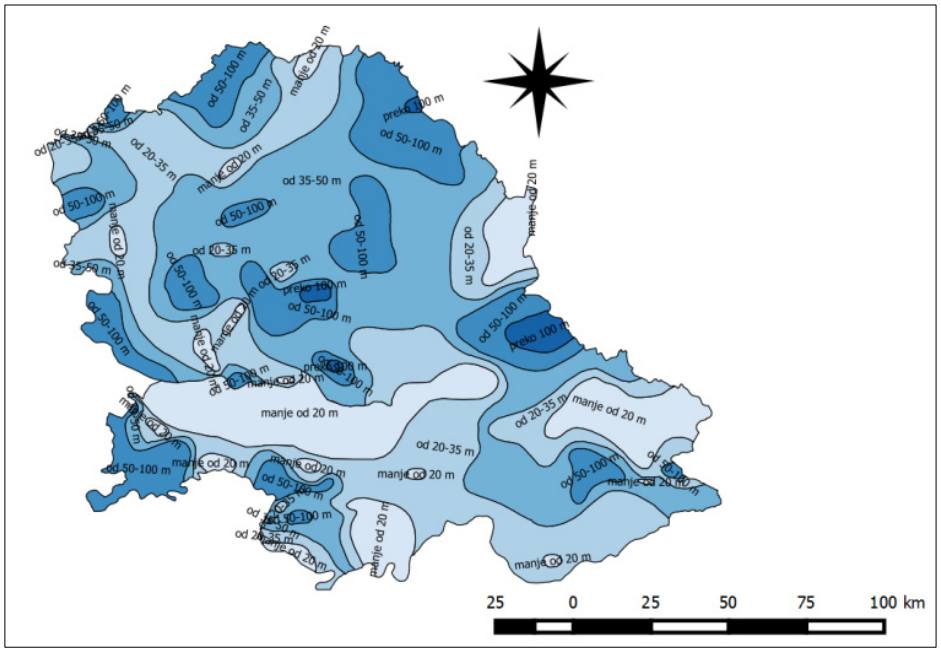

Figure 2. Thicknesses of water-supply layers

Based on the thickness of water-supply layers, we can estimate the quantity of water available for exploitation and thus recognize spatially-based conflicts. By proportion of water consumption and thickness of water-supply layer, the biggest conflict is in municipalities on water-supply layers less than 20 meters (Fig. 3).

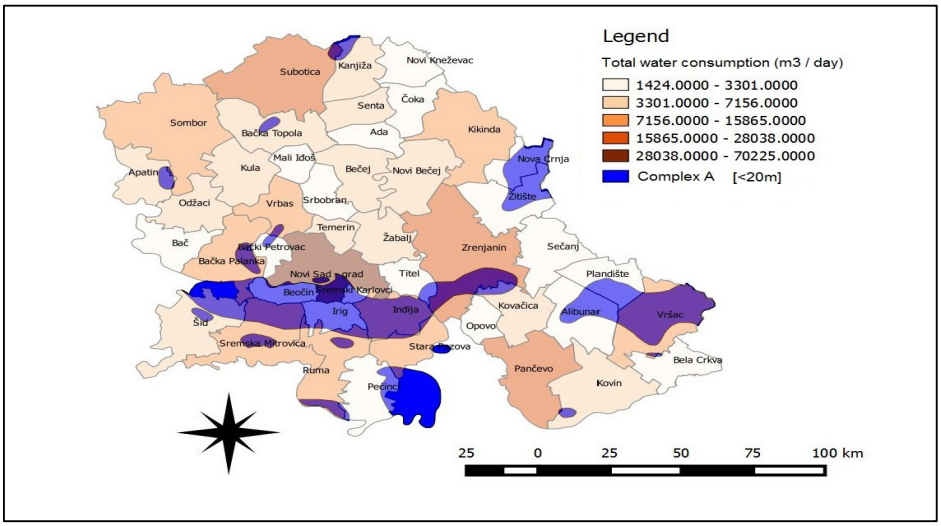

Figure 3. Water resource conflicts

Figure 3 clearly shows that municipalities of: Nova Crnja, Vršac, Alibunar, Inđija, Sremska Mitrovica, Irig and Beočin are in the zone of thinnest water supplies. From above mentioned municipalities, a conflict particularly stands out in following municipalities: Inđija, Sremska Mitrovica and Vršac.

Also, water supplies in the following category of water-supply layers, 20m to 35m, although bigger than the above mentioned, in spatial proportion with a particularly big consumption indicate conflict of managing water resources of a certain municipality.

Figure 4 shows the next level of conflict, a relatively thin water-supply layer and big consumption in spatial inter-dependence. We can conclude that municipalities of Subotica, Zrenjanin, Novi Sad and Pančevo are in the zone of thin water supplies and with huge consumption.

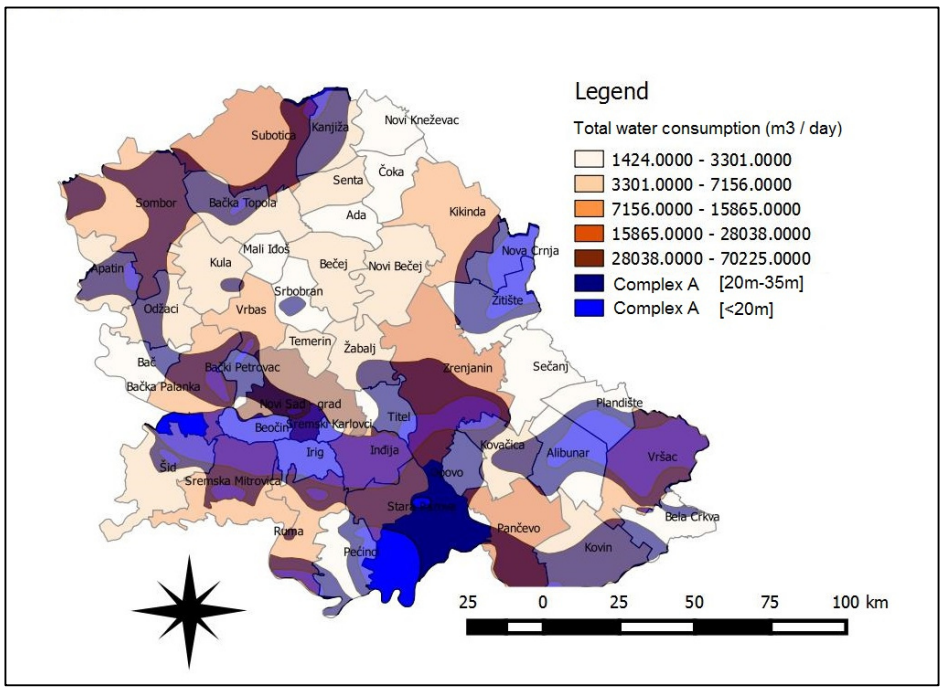

Figure 4. A thin layer of aquifer and high consumption in the spatial interdependence

On the basis of previous conclusions, it can be said that, territorially speaking, approximately half of Vojvodina has a conflict between reserves and water consumption. Viewed through population size, it can be concluded that:

- number of inhabitants in the zone of high conflict is: 179.399,
- number of inhabitants in the zone of conflict is: 729.955.

Total number of inhabitants under conflict in Vojvodina is 909.354, approximately half of the total population.

IV. CONCLUSION

The ability to display data at different geographical layers listed GIS as essential information system for decision making in spatial planning and more efficient, cost effective for monitoring human impact on the environment. GIS enables simulation of different hazardous situations by modelling conditions for risk realisation, allowing the prediction of possible consequences.

The aim of this study was to point out the capabilities and importance of geoinformatic application in field of water management and to draw attention to the emergence of a hydrological conflict due lack of available water and water shortage in Vojvodina.

By manipulating spatial data in the zone of interest, risk maps were created. It is found out that hydrological conflicts exist, and according to water consumption and projections of meteorological and hydrological conditions in the future, there will be more conflicts.

Identified conflicts occur as a result of groundwater consumption that is used for irrigation. 50% of irrigation water is extracting from groundwater catchments and that has direct impact on groundwater level decrease. If irrigation

politics in Vojvodina do not shift to surface water in the future, detected conflicts will intensify and risk zone will change.

All previously mentioned leads to the conclusion that it is necessary to introduce students who are interested in risk management with geoinformation technologies. By incorporing GIS into the national curriculums students will be trained to asess potential risk of interest and to make adequate decisions.

ACKNOWLEDGMENTS

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Modernization of Elementary School Employees Advanced Training

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Abstract - This paper deals with the topic of teachers' vocational advanced training in elementary schools. The aim is to reveal the examinees' attitudes and opinions about the modernization of advanced training. It is devoted to vocational advanced training and professional cooperation between teachers. The paper describes through a research work the effort to confirm the hypothesis that vocational advance training of teachers in elementary school should be modernized.

I. INTRODUCTION

The rapid course of development conditions the continuity of human education and advanced training that are not a static process, but it requires continuous activity, advancement, and professional development of teachers. [11].

The environement that impacts the work of teachers, divesity of manners and approaches to organizationa and realization of the educational and pedagogical work condition the existance of teachers' mupliple roles. In order to keep up with the set reguirements, it is necessary the teacher throught the process of vocational advanced traning to comprehend contemporary knowledge, and skills. [11].

The reform of education may be defines as a set of organizational measures to suiting the educational system to the requirements of the society in order to realize the social role of education more successfully in under certain conditions. The national educational reform strategy in the Republic of Serbi sets as its challenge decentralization and depoliticise the edcuational system. It has to be effevtive, creative aimed to learning and based on the outcomes that come from the educational standards. It has to be a system that will promote cultural evaluation, qualitative progrms, but also a system that encompasses life long learning that represents a set of life long learning activites with theaim to improve knowledge, skills, and abilities. [9].

II. THEORETICAL APPROACH TO THE PROBLEM

A. Vocational advaced traning and teachers' cooperation in elemenetary school in Serbia

TIMSS (Trends in International Mathematics and Science Study) is an international research of 4th and 8th elementary school level pupils' educational attainment in the field of mathematics and natural sciences. (Mullis et al, 2005). The research is conducted every four years. The Institute of Pedagogical Research and the Office of Quality Evaulation in Education are responsible to carry out the research in Serbia. The TIMSS 2007 research was conducted in April 2006. The specimen covered 217 teachers – 144 women (66%) and 73 men (34%) [10].

The data in the following areas were collected: teaching content, working methods, curriculum and syllabi, use of information technology, improvement of pupils' critical thinking and knowledge grading. The teacher were aksed if they had had advanced traning during in these areas during the last two years from the date of filling in the questionare. The results of the research are presented in Table 1.

TABLE I. TEACHERS' PARTICIPATION IN VOCATIONAL ADVANCED TRAINING (%)[10].

Area of advanced training	Mathematics	Biology	Geography	Physics	Chemistry	TOTAL
Content	59	75	56	60	59	60
Working methods	40	35	38	15	39	31
Curriculum and Syllabi	42	24	17	22	21	24
Information Technology	33	56	54	32	45	44
Critical thinking	29	54	42	45	53	41
Knowledge grading	42	6	6	15	14	16

The TIMSS 2007 research verified the need for innovative and developing approach in advanced

vocational training field. 60% of the specimen of TIMSS 2007 has advanced training in the teaching content field. The advanced training fields are as it follows information technology (24%), critical thinking (41%), working methods (315), curriculum, and syllabi (24%), and at least knowledge grading (16%). Discussions about items learning and work on preparing didactic materials are the main topics of teachers' professional cooperation. While attending other teachers' classes is a very rare phenomenon – even 70% of teachers have never or almost never done it [10].

B. Accredited programs of teachers' advanced training – state of art and needs

The subject of the research referred to elementary and secondary school teachers' opinion about the quality, manner of realization and problems connected to advance training realization through accredited programs. The aim of the research was directed to perceive the state in the teachers advanced training field through accredited programs and identifying needs and possibilities of problems in realization the same. A questionnaire was used to collect data. During the school year 2009/2010the, the examinees were pre-school teachers, elementary and secondary school teachers in five counties of the Republic of Serbia. The number of the examinees was 786 as it follows 107 (13.61%) pre/school teachers, 507 (64.50%) elementary school teachers, and 172 (21.88%) secondary school teachers.

The first assignment of the research was to determine the state connected to the data related to the hours of teachers' programme attendance during the previous five years. The results show that a certain number of examined teachers did not fulfilled the legal order to attend obliged accredited programs. A specific indicator is that one/third of the examined teacher; exactly 31.43% have over 100 hours of advanced training that may point to the presence of voluntary motif and openness to obtain new knowledge, skills, and competency as well as to improve their own work, Table 2.

TABLE II. HOURS OF ADVANCED TRAINING

Hours of advanced training	f	%
0-50	205	26,08
51-100	334	42,49
Over 100	247	31,43
TOTAL:	786	100,00

Considering the fact that all examined pre-school teachers and teachers had attended accredited programs, they could express their own opinion about how they were satisfied with the organization and realization of such a kind of advanced training.

The researches points out that it is necessary to access teachers' advanced training problem systematically and seriously, the quality of the advanced training program may also be an important problem that have to be researched, and the criteria and standards have to be determined as well.

III. RESEARCH FRAMEWORK METHODOLOGY

Moving toward information technology systems, global information exchange as well as numerous specific requirements of modern technology caused the need to adjustment of educational systems together with teachers' adjustments. The aim of teachers' development is to realize qualitative results in education. The teacher becomes an active participant of improving training educations work and he develops openness toward permanent learning. Teacher's professional development is a long lasting process through which knowledge is complemented by learning, practical work and research activity, and skills are developed, too. [8].

Knowledge is necessary to survive the modern world of stormy and numerous changes. It is obtained by formal and informal education that is very important in the function of the everybody's professional specialization and development. Accepting the concept of lifelong learning the teacher who is willing to get advanced vocational training will find the way to achieve his own development including education via distance learning. [4].

In order to approach the teachers' vocational education system qualitatively it is necessary to review permanently and to research the advanced training, program quality that are offered to teachers and validity of the advanced training concept based legally [5].

The subject of the research is Modernization of teachers' advanced training.

The problem of the research is: Elementary and secondary schoolteachers' attitudes and opinions about vocational advanced training and advanced training modernization.

This research has a goal to uncover and determine elementary school teachers' attitudes and opinions about the necessity of advanced training modernization in elementary schools.

The assignments of the research are:

1. Examine teachers' opinion about the importance of continuous vocational

training in order to keep their work and knowledge on a satisfactory level.

2. Searching for examples of what teachers take into account when they plan their vocational training.
3. Examine the teachers' interest about training manner (theoretical purpose, or theoretical and practical)
4. Analyzing teachers' observations connected to the most necessary fields of advanced training.
5. Examine the teachers' opinions about advanced training contribution to actual topic improvement.
6. Determine if better cooperation between schools (common seminars, exchange of experiences) would contribute to advanced training modernization.
7. Determine if using Information Communication Technology would contribute to better advance training modernization.
8. Examine the opinion about online seminars and if their spreading would contribute to more successful advanced training.

Schmidt mentions three methods of pedagogic research:

1. historical
1. descriptive,
2. experimental (Mužić V. 1977., page 63.)

The descriptive method will be used in the research. A survey to collect data will be used, and the instrument is a questionnaire.

A survey in pedagogical research is a process in which the examinees are asked questions related to the facts of scientific interest in pedagogy, and that are known to the examinees, or questions related to the examinees' opinion. The examinees give their answers in written form. (Mužić V. 1977., page 262).

A questionnaire contains twenty-four questions used to examine teachers' attitudes and opinions related to vocational advanced training and training modernization. The questionnaire is anonymous, thus it is expected from the teachers to give honest answers. Combined questions (open and close) are used.

The hypothesis of the research is: It is necessary to modernize elementary school teachers' vocational training.

The research sample covered teachers who came to "Winter Faculty 2017" and meant for teacher training according to the accredited program from the ZOUV catalogue. "Zimski Fakultet 2017" was organized by the Teacher's faculty in the Hungarian Language in Subotica (MTTK) from 4th to 6th January, 2017.

67 examinees were questioned. 50 were head teachers, 17 were subject teachers. The teachers encompassed genders, various ages, different working experience in teaching

A. Interpretation of the research results

The first five questions in the questionnaire were of personal nature (gender, age, working experience and level of qualification).

Out of 67 examined teachers, there were 4 (4%) men, and 64 (96%) women. These data are in Table 3.

TABLE III. THE GENDER OF EXAMINEES

Gender	Total number	Percentage
Male	3	4 %
Female	64	96 %

Data related to the age of the examinees show that most of the examinees were between 45-50 years old (33 examinees, 49%), then come the ones between 35-45 age (18 examinees, 27%), examinees up to 35 age (11 examinees, 16%), while in the smallest group there were the examinees who were 55-65 years old (5 examinees, 8%). The overview the examinees' age category is given in the in Table 4.

TABLE IV. THE AGE OF EXAMINEES

Age	Number of teachers	Percentage
do 35	11	16%
35-45	18	27%
45-55	33	49%
55-65	5	8%

Out of 67 examined teachers, 50 persons (75%) work as head teachers and 17 (25%) as subject teachers. The data may be seen in Table 5.

TABLE V. EXAMINEES' WORKING PLACE

Working place	Total number	Percentage
Head teacher	50	75 %
Subject teacher	17	25 %

Data related to the examinees' working experience show that most of the examinees have 25-35 working experience (25 examinees, 37%), then come the examinees who have 15-25 years (24, 36%), and then examinees who have up to 5 years of working experience (9 examinees, 13.5%), as well as the examinees who have 5-15 years of working experience (9 examines, 13.5%).

The overview of the category working experience is given in Table 6.

TABLE VI. TEACHING WORKING EXPERIENCE

Teaching working experience	Number of teachers	Percentage
0-5	9	13,5%
5-15	9	13,5%
15-25a	24	36%
25-35	25	37%

According to the qualification level, the data show that the most examinees (30 examinees, 45%) completed university level education, 21 people (31%) completed master studies. 13 (9%) persons completed college, and 3 persons (5%) obtained higher education. The noted data may be seen in Table 7.

TABLE VII. QUALIFICATION LEVEL

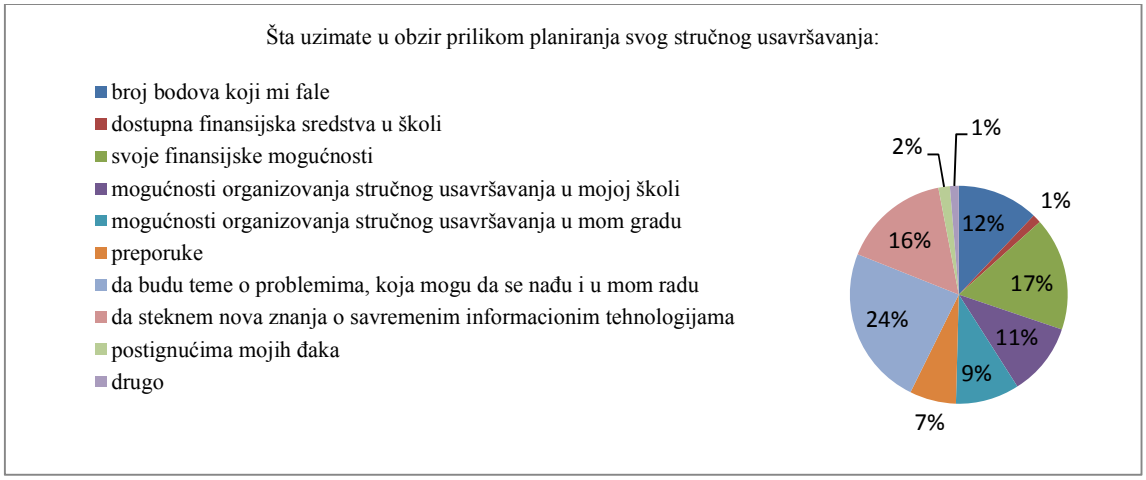
Completed level	Number of teachers	Percentage
College	13	19%
Higher education	3	5%
Faculty	30	45%
Master	21	31%

All 67 (100%) examinees answered the sixth question that it is important to them to get permanent vocational training in order to keep their own work on a satisfactory level.

To the 7th question, the examinees could choose among some answers concerning their choice related to advance training. They circled the answer "topics related to the problems that may occur in my work" as follows: 55 (24%) examinees, 39 (17%) examinees circled the answer that they consider their financial possibilities. In order to obtain new knowledge in contemporary information technology 37 examinees (16%) circled the answer. 28 (12%) examinees look for the points they need. 25 examinees (11%) take into account if the training could be organized in the school where they work. 22 examinees (9%) circled the answer related to the importance of training. 16 examinees (7%) take into account the references. 4 times (2%) the examinees take into account their pupils' achievement. 3 (1%) examinees circled the answer that they take into account the financial means of their school. In addition, the last question was circled 3 times concerning any answers. The answers were: (1) they concern about quality, (2) competency of teacher, and (3) where school sends them necessarily. Data survey is given in Table 8. and Graph 1.

TABLE VIII. DATA CONCERNING EXAMINEES' TRAINING, WHAT THEY TAKE INTO ACCOUNT WHILE PLANNING

What do you take into account while planning your advance training	Number of examinees who circled the given answer	Percentage
Number of points they need	28	12%
Available financial means at school	3	1%
Own financial possibilities	39	17%
Possibilities of organsing advanced training at my school	25	11%
Possibilities of organsing advanced training in my city	22	9%
Recommendations	16	7%
Topics about problems that can occur in my work	55	24%
To obtain new knowledge about contemporary information technologies	37	16%
Pupils' achievements	4	2%
Other	3	1%

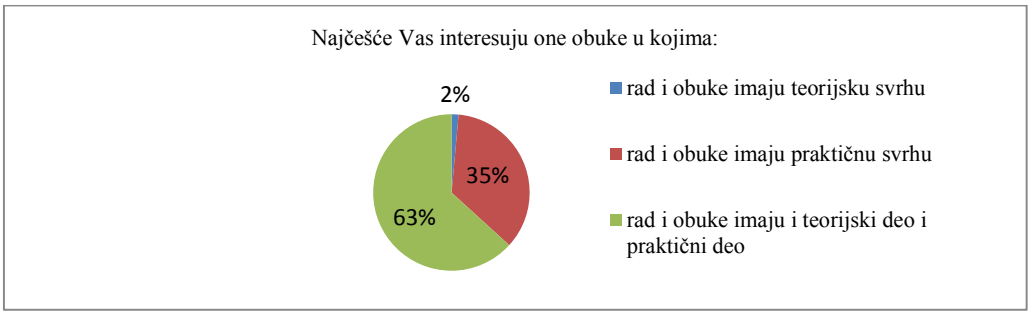


Graph 1. Graphic view of examinees' share percentage related to what they take into account while planning advanced training

The 8th question in the questionnaire looks for answer related to manner of advanced training. The most examinees 43 (43%) answered that they were most frequently interested in advanced training concerning work and training contain theoretical and practical parts. Follows a group of examinees 25 (35%) who expressed that they were interested in training concerning work and training that have practical purpose. Only 1 (2%) examinee answered that work and training should have theoretical purpose. The results may be seen in Table 9, and Graph 2.

TABLE IX. EXAMINEES' INTEREST CONCERNING THE CONTENT OF TRAINING

Most frequently interested in training that::	Total number	Percentage
Work and training concerning theoretical purpose	1	2 %
Work and training concerning practical training	25	35%
Work and training concerning both theoretical and practical parts	43	43%



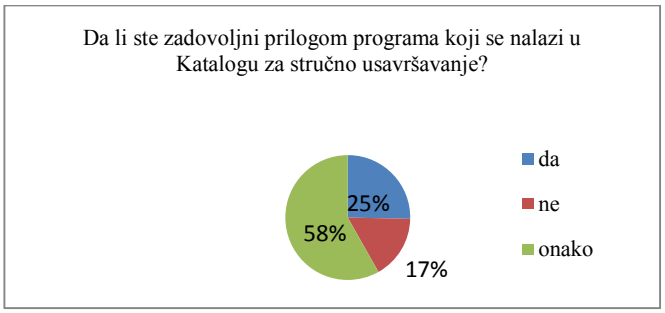
Graph 2. Graphical presentation of examinees percentage according to training content interest

Concerning the quality of training all examinees 67 (100%) agreed that the quality of the program is important to them.

The question if they were satisfied with the program appendix from the Catalogue, the largest number of examinees, 39 (58%) answered that they were "like that" satisfied. 17 (25%) examinees were satisfied, and 11 (17%) were not satisfied with the program. Table 10 and Graph 3 show how the examinees answered.

TABLE X. OPINION ABOUT THE PROGRAM FORM THE CATALOGUE ZUOV

Are you satisfied with the program appendix that is in the Catalogue for vocational advanced training issued by the Institute for Improving Education and Training	Total number	Percentage
Yes	17	25%
No	11	17%
"like that"	39	58%



Graph 3. Graphical presentation of examinees percentage concerning the Catalogue appendix

The 11th question related to the wish of the examinees concerning the frequency of vocational advanced training. 54 (81%) answered "yes", while 13 (19%) answered "no". The data may be seen in Table 11.

TABLE XI. REGULARITY OF VOCATIONAL ADVANCED TRAINING

Do you wish vocational advanced training to be held more frequently?	Total number	Percentage
Yes	54	81%
No	13	19%

The 12th question referred to obtain point by attending seminars. 53 persons (79%) thought that it was not the case, while 14 persons (21%) answered "yes". The data may be seen in Table 12.

TABLE XII. EXAMINEES' OPINIÓN ABOUT OBTAINING POINTS

Do you think that seminars you attend are intended to obtain points for vocational advanced training?	Total number	Percentage
Yes	14	21%
No	53	79%

28 examinees (42%) did not answer the 13th question. Those who did, wrote that they needed vocational advanced training in the following areas: information communication technologies, interactive teaching, use of interactive board, language and literature (language usage, communication, grammar), mathematics, physical training, music, art (practical ideas, technics), organization of group work, ecology and recycling, administration management, first aid.

All examinees, 67 (100%) said that it is necessary to improve and upgrade the system of vocational advanced training in order to follow the latest achievements.

All examinees (67 persons, 100%) thought that advanced training would improve actual topics.

The largest number of examinees (59 persons, 88%) said that they were satisfied, while eight persons (12%) were not satisfied with the quality of the training they had attended. The noted data may be seen in Table 13. Those who were not satisfied with the quality gave the following reasons: "very often, there are no usable practical ideas, only theory", "usually they become boring because they talk about one topic too much", "lack of practical part", it was monotonous", "the topics are not actual and I cannot use them", "and very often it could not be used in practice".

TABLE XIII. DATA RELATED TO THE QUALITY SATISFACTION OF THE ATTENDED TRAININGS

Are you satisfied with the quality of the training you have attended so far?	Total number	Percentage
Yes	59	88%
No	8	12%

Data about the question if they apply in their work they had learnt during the training are as follows: 26 examines said that they used (39%), and 41 (61%) persons said that they did not use. The noted data may be seen in Table 14.

TABLE XIV. DATA CONCERNING THE RANGE OF USING KNOWLEDGE OBTAINED DURING TRAININGS THEY ATTENDED

Do you apply training you attended in your work?	Total numberj	Percentage
Yes	26	39%
No	41	61%
Sometimes	0	0%

45 persons (67%) said that advanced training helped moderately the development of education. The others (22 persons, 33%) that that it helps a lot. Nobody (0 persons, 0%) gave negative answer. The data are given in Table 15.

TABLE XV. DATA CONCERNING THE RANGE OF ADVANCED TRAINING HELP TO EDUCATION DEVELOPMENT

What do you think? How much does vocational advanced training help the development of education?	Total number	Percentage
A lot	22	33%
Moderately	45	67%
Does not help	0	0%

A great number of examinees (52 persons, 78%) said that it would be necessary the directors to engage themselves more in vocational advanced training. Only 15 persons (22%) said that it was not necessary. The data are given in Table 16.

TABLE XVI. NECESSITY OF DIRECTORS' ENGAGEMENT IN ADVANCED TRANING

Would it be necessary to engage directors more in vocational advanced training?	Total number	Percentage
Yes	52	78%
No	15	22%

All examines (76 persons, 100%) agree that vocational advanced training should be financed better. 65 persons (97%) circled the answer "yes", while only 2 persons (3%) circled the answer "no" to the question if better cooperation between schools would contribute to modernizing vocational advanced training. The noted data may be seen in Table 17.

TABLE XVII. DATA ABOUT THE OPINION IF BETTER COOPERATION BETWEEN SCHOOLS WOULD CONTRIBUTE TO ADVANCED TRAINING

Would better cooperation between schools contribute to modernizing vocational advanced training (common seminars, experience exchanges)?	Total number	Percentage
Yes	65	97%
No	2	3%

All examinees (67 persons, 100%) said that information and communication technologies would contribute to the modernization of advanced training.

A great number of examinees (43 persons, 64%) said that they had not attend online seminars, 22 persons (33%) said that they had attend online seminars, while only 2 persons (3%) said that they heard about it for the first time. The data are shown in Table 18.

TABLE XVIII. DATA CONCERNING THE FREQUENCY OF ONLINE SEMINRS

Have you ever taken part in an online seminar	Total number	Percentage
Yes	22	33%
No	43	64%
I heard for this opportunity for the first time	2	3%

1

50 persons (75%) circled "yes", while 17 persons (25%) circled "no" the answer to the question if online seminars related to vocational advanced training would spread to a wider area. The data are shown in Table 19.

TABLE XIX. DATA CONCERNING THE OPINION OF THE EXAMINEE ABOUT BETTER VOCATIONAL ADVANCED TRAINING DUE TO ONLINE SEMINARS SPREADING TO WIDER AREA

What do you think? Would vocational advanced training be more successful if online seminars spared to a wider area?	Total number	Percentage
Yes	50	75%
No	17	25%

IV. CONCLUSION

The results of the research have shown that it is important to the teacher to get vocational advanced training permanently in order to keep their work on a satisfactory level. Everybody said that it was important. It appears that it is very important to obtain new knowledge for the examinees who took part in „Zimski fakultet 2017" in order to advance in their work.

A greater number of teachers think that seminars are not intended only to get points. Due to the number it is a positive message for they do not „rush" to get points, but they are motivated and have desire to get advanced training. The

results show that the quality of vocational advanced traning is also improtant for the examinees. They would like the advanced traning to be organized more often.

The results of the research have shown that the vocational advanced training system should keep up with time. The teachers have agreed that advanced trainings would be improved if actual topic were used.

A great number of examinees think that there should be better cooperation between schools. All examinees confirmed that use of information communication technologies would contribute to modernization of vocational advanced training especially for many of them have not taken part in any online seminars. Using online seminars would increase advanced training improvement.

The results obtained by this research confirm the hypothesis of the research: vocational advanced training of elementary school teachers should be modernized.

Such researches points to the necessity of systematic and serious approach to the problem of teachers' advanced training. The quality of the advanced training program may also be a very important problem. It should be researched and the criteria and standards that define it should be determined.

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Exploring Educational Dilemmas Using the System Dynamics and Archetypes

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Abstract - This article describes how the systems archetype 'Drifting Goals' can be used in the classroom to explore ethical dilemmas. Systems archetypes are systems thinking tool that provide a framework that shifts the focus from seeing ethical dilemmas as stemming from the acts of individuals to a focus on the systemic interrelationships and interactions within the organization. The use of the 'Drifting Goals' archetype provides a pedagogical approach that exposes students to innovative ways of thinking about ethical problems and the structures that create them.

A common approach to teaching business ethics is to give students case studies of "ethical themes" or ethical breaches in workplaces and organizations. As is appropriate in the study of ethics or education, these focuses on individual values and decision making. The rationale for this approach is that this will give students the tools for improved ethical behavior in the workplace. Essentially it is a focus on the role of the individual in business ethics and the assumption underlying this approach is that educating individuals to be ethical will lead to ethical behavior in the workplace. An additional strategy is to develop and explore the structural and systemic factors that lead to ethical breaches. This approach explores the tension between the role of the individual and the role of organizational structure in determining behavior.

I. INTRODUCTION

This paper proposes a definition of systems thinking for use in a wide variety of disciplines, with particular emphasis on the development and assessment of systems thinking educational efforts. The definition was derived from a review of the systems thinking literature combined with the application of systems thinking to itself. Many different definitions of systems thinking can be found throughout the systems community, but key components of a singular definition can be distilled from the literature. This researcher considered these components both individually and holistically, then proposed a new definition of systems thinking that integrates these components as a system. The definition was tested for fidelity against a System Test and against three widely accepted system archetypes. Systems thinking is widely believed to be critical in handling the complexity facing the world in the coming decades; however, it still resides in the educational margins. In order for this important skill to receive mainstream educational attention, a complete definition is required. Such a definition has not yet been established. This research is an attempt to rectify this deficiency by providing such a definition.

The System Test, shown in Figure 1, was devised as a means by which to test a system thinking definition for systemic fidelity. The test is relatively simple. Each definition will be examined to determine if it contains these three things:

1. Function, purpose, or goal. This should describe the purpose of systems thinking in a way that can be clearly understood and relates to everyday life.

2. Elements. These elements will manifest as characteristics of systems thinking.

3. Interconnections. This is the way the elements or characteristics feed into and relate to each other.

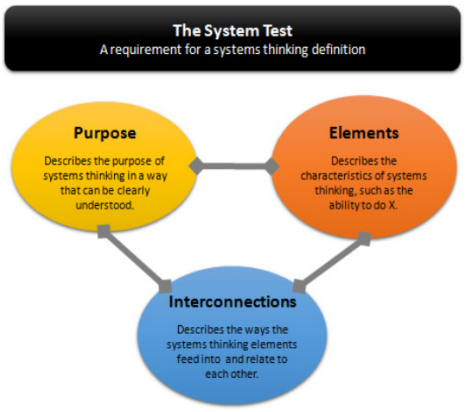

Figure 1. The System Test

Of course, the simple fact that a definition describes systems thinking as a system does not necessarily mean it is a correct definition. However, the System Test should be considered as a necessary, but not sufficient set of criteria for a system thinking definition to be considered complete.

II. SYSTEM THINKING

Jay Forrester's definition was: "As a contrast to the discussion on what systems thinking is, it is important to consider one example of what systems thinking is not". Jay Forrester, known as the founder of System Dynamics, presents just such a definition. Even though he uses the term systems thinking" differently, or perhaps because he does, his definition should be considered in order to comprehensively discuss systems thinking. He writes (1994): "Systems thinking" has no clear definition or usage. Some use systems thinking to mean the same as system dynamics. "Systems thinking" is coming to mean little more than thinking about systems, talking about systems, and acknowledging that systems are important. In other words, systems thinking implies a rather general and superficial awareness of systems. The systems thinking that Jay Forrester is writing about here is not our systems thinking. He appears to be using the term in a different way. However, note Dr. Forrester's assertion that systems thinking has no clear definition or usage – this again reinforces the need for a complete, widely accepted definition.

It is important for students to discover that in fact or fiction "the more things change, the more they stay the same." It is important for students to relate present events to the patterns of behavior created by a particular sequence of events. It is important for students to reason that these patterns of behavior show-up repeatedly, therefore outcomes might be predictable and leverage points for change could be recognized and developed. It is important for students to connect ideas, to find one truth in the light of another, and to develop a broad foundation for the depth of knowledge to be acquired. The desired results for the students are that they learn to relate sequences of events to patterns of behavior, they learn to detect the operating structure of a system, they learn to recognize archetypes of systems, they learn to recognize causal loops operating in systems, and they learn to understand the process by which actions are prompted by beliefs "which are based on conclusions inferred from observations plus experiences." (adapted from Fifth Discipline Field Book, p.242, Rick Ross)

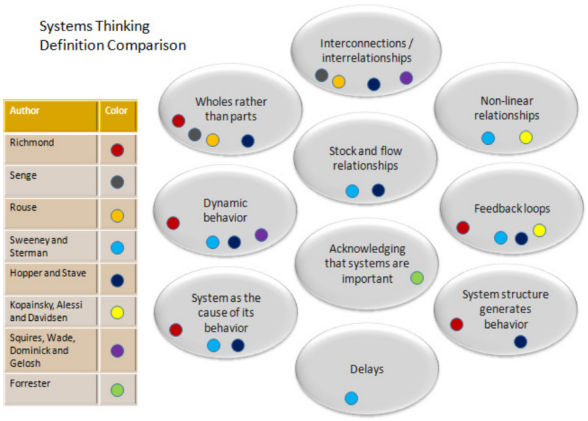

Figure 2. The System Thinking

III. DRIFTING GOAL ARCHETYPE

Systems archetypes are system thinking tool that provide a framework that shifts the focus from seeing educational or ethical dilemmas as stemming from the acts of individuals to a focus on the systemic interrelationships and interactions within the organization. The use of the 'Drifting Goals' archetype provides a pedagogical approach that exposes students to new ways of thinking about ethical problems and the structures that create them.

Systems archetypes are a particular type of systems thinking tool that provide a visual illustration of the common challenges that occur in all kinds of industries and organizations. When organizations are faced with the same types of problems recurring then there is likely to be a systems archetype operating in the background. In the Fifth Discipline, Senge (1990) identified eight archetypes which he believed constitute consistent patterns of behavior in organizations. Kim (1990) defined systems archetypes as a set of common dynamics that recur in many different situations. The use of the archetypes can assist students in identifying common systems behaviors that may fit into one of these recurring patterns (Kim, 1990).

The drifting goals archetype is a visual tool that can provide a vehicle for students to understand the interrelationships and patterns of change that often form the basis of ethical dilemmas and erosion of ethical standards. The emphasis with this systems archetype is developing an understanding of the dynamics of behavior over time. In other words, it allows a focus on the ongoing rather than immediate effects of ethical dilemmas. Ethical standards operating in organizations can diminish over time and the "Drifting Goals Archetype" provides a basis for

understanding the dynamics of why this is likely to occur.

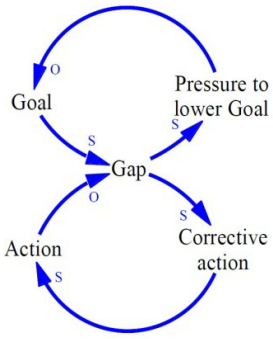

Figure 3. The Drifting goal Archetype

In a drifting goals archetype, a gap between the goal and current reality can be resolved by taking corrective action or lowering the goal. The critical difference is that lowering the goal immediately closes the gap, whereas corrective actions usually take time. The second half of the Drifting Goals archetype is added in Figure 3.

Now the increase in the gap is met by corrective action (a change in policy, procedure or structure) and new action or behavior closes the gap, in some way other than eroding the goals or standards. The underlying dynamics of this archetype are that a company finds there is a gap between standards they aspire to and some set of new demands. A simple example of this is dropping quality standards to meet tight deadlines. The lowered standard can become the accepted standard and with each cycle through the loop, the standard drops again. The 'quick fix' is to lower standards to meet the pressures. This in turn makes it easier to lower the goal or standard next time. This cycle is also an excellent example of behavior over time being driven by system structure. The longer term, and often more difficult, solution involves making fundamental changes that maintain standards and meet the new demands. However, the longer-term solution involves a lag between the corrective action and the new performance at the desired standard (Kim, 1992).

IV. CONCLUSION

The ability of our world's citizens to perform effective systems thinking is extremely important to the world's future. The use of systems thinking transcends many disciplines, supporting and connecting them in unintuitive but highly impactful ways. Thus far, the systems thinking skill set has remained on educational margins for a variety of reasons. One of these reasons is the absence of a widely accepted, complete definition of systems thinking. Proposed in this paper is such a definition. The proposed definition passes a System Test, confirming its systemic fidelity. The definition includes a clear goal, elements of systems thinking, and descriptions of interconnections between these elements. The definition synthesizes the most common and critical systems thinking competencies discussed in the literature. Moving forward, this definition can be used for systems thinking educational efforts, systems science, and a myriad other discipline which require the use of critical systems understanding and intuition.

The drifting goals archetype is best used in conjunction with a wide range of teaching techniques. A fundamental tenet of systems thinking is the provision of multiple perspectives on any given problem. As we have said, some students get more insights using these techniques than others. Some are more comfortable with traditional organizational behavior instructional approaches but the use of archetypes does help explore issues from an alternative paradigm. The drifting goals archetype is useful in explaining situations educational or ethical dilemmas where key causalities can be identified and where it is important to identify long-term behavioral implications of management decisions. In this context, systems thinking lends itself to case studies and discussions of situations where recurring patterns of ethical dilemmas are likely to be present.

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Pedagogical Aspects of E – learning

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Abstract - Application of e-learning awakens the interest of all participants in the educational process because of its ability to facilitate and improve communication between teaching content and pupils, as well as between teachers and pupils and between pupil-pupil. Also, the contents of which should be overcome are multimedia formed, which provides multiple perceptions of pupils. In this way promotes comprehensive development of pupils, knowledge and skills to be acquired are more durable, more applicable, and all because the pupil has a maximum individual active and engaged, driven by their own ambition and desire for education. The paper presents the pedagogical aspects of e-learning, his domain, but also the possibilities of its implementation in the classroom.

I. INTRODUCTION

In a didactic is established term "didactic triangle", composed of the pupils, the teacher and the instruction content. However, in recent times all the present term "didactic quadrangle" that triangle supplemented by educational technology. The ordinary meaning of the word technology is the methodology of designing and manufacturing a product. The term educational technology is widely used some 40-odd years in pedagogy, and refers to a systematic educational process versed scientific methods directed towards achieving the goal of education.

International Association AECT define the educational technology in 1977: "Educational technology is a complex integrated process which involving people, procedures, ideas, devices and organization for analyzing problems, planning, implementation, evaluation and implementation of solutions of these problems, in situations where the learning practical and controlled "[1].

The term "educational technology" refers to the concepts, theory and field work, and focuses on facilitating learning through technology, provided that learning is "practical and controlled" how it stand in the previously defined fields [2].

Although the "educational technology" and "teaching technology" is sometimes used interchangeably, it is a broader and more specific processes. Teaching is narrower than education, in the case that it applies to situations that are meaningful, ie. in which the pupil is directed to a specific goals or tasks posted by another, and more controlled, ie. Teaching methods are used and resources are planned and led by someone else. Thus, a subset of teaching education, teaching technology subset of educational technology. The purpose of educational technology is to help increase the performance of education and the learning process, by which is meant:

- Interest in pupil. Getting to know the pupil's personality dispositions, such as preferences, interests, triggering of cognitive processes and abilities.

- Achieving of the placed educational goals. The aim of education determines the content, organization, methods, implementation methodology and evaluation criteria. The objectives of education and teaching are subordinated to the overall objective, which is elaborated according to the time period in which it is possible to achieve. The goal determines the content, the content is determined by the methods, techniques and means of teaching.

- Improving the quality and quantity of pupils learning. The organization of work and teaching significantly affects the character of pupils to meet the needs of a digital society. Using modern educational technology tool teachers are becoming more complex and require more work and effort expended, but it all makes up for achieving a better „quality of pupils".

- Organization of forms, means and methods of work. Effective teaching that promotes cognitive activity of pupils enrich teaching forms, methods and means. Active participation, autonomy of pupils in gaining knowledge and their application is conditioned by a combination of forms of teaching, introducing new methods of work and the application of traditional and modern teaching aids.

- Evaluation of pupils work. The main task of the evaluation is to determine the extent to which the goals of education. It means just what it seems more complete personality development and causes its progression. In addition to these general observations objective evaluation and detection of

potential problems and take appropriate measures for their rehabilitation [3].

In recent years there have been many changes in the theory and practice of educational technology. New understanding of the process of human learning and nature of knowledge itself caused educators to rethink basic concepts that rely on teaching methods. Advances in information and communication technology (ICT) have changed and expanded capabilities to support learning in the classroom and distance learning. The more you have digitized learning resources, these are the ease and efficiency of transfer increases, all this represents a new challenge to conventional wisdom about how to create, store, and use of resources.

Modernizing and transforming of the educational technology changing environment and current business processes, thereby freeing pupils from the school experience as a foreign non-recent phenomenon, and giving him the additional options of action based on the cooperative relationship with the teacher. At the same time, the teaching material is accepted as part of the game and learning as an integral part of their life.

What changes and opportunities brings E learning in the pedagogical meaning? These are above all:

- First of all, it is the flexibility of time and place of teaching attendance. While in the traditional system of education geographical coincidence of the necessity of conducting classes, today it is quite irrelevant detail. It is not necessary that all participants in the educational process in the same place and at the same time. Of course, part of formal schooling, this claim is only a minute additional work with pupils where they need to get used to, and above all to learn that information can be acquired in this way, what you will encounter at some point later life. Most modern professions and professional associations, including social work, requires its members to undergo specific training over time in order to keep the license for work or find themselves working on new fields of practice. Continuing education occupies an important place in the institutions, because the process of change in the provision of required and adequate training of staff. The development of new technologies, especially the Internet, creates conditions for additional education, "distance learning". There are different types of teaching with regard to time and place: same time, same place (the classic classroom with multimedia presentations); the same time, different places (videoconferencing, chat rooms (chat rooms); different times, the same place (workstations, the ad panels (bulletin boards); different times, different places (e-mail, network forums, video conferencing, „shared“ database, individual network places for learning).

- Individual approach to pupils. Focus on participants (suitable for adult education), insisting on developing thinking, acquiring new skills. The main characteristic is the high level of learning individual teaching. Moving pupil from the groups in a traditional classroom, where a quieter some louder, some progress faster, some slower, before a computer monitor in his natural environment represents a fundamental change in educational philosophy. They are absolutely different psychological, didactic and methodological circumstances. Tempo and dynamics adapts to the individual, the amount of information per unit of time also, the external pollution of are reduced to a minimum. Of course, this can applies in higher education).

- The following educational aspect was interactivity mixer: pupil - pupil; pupil - teacher; pupils - teacher. To make e-learning successful, should allow several modes of communication: discussion forums and fast data exchange, E-mail, audio communication.

- The obviousness of teaching. In the process of creating educational software there is a chronological sequence of activities. The first step in it is the selection of suitable educational content software. Maximum utilization of computing capability is primarily a pupil approaching the invisible, remote or abstract concepts and phenomena abundance of multimedia capabilities of computer animation and simulation is upon exercise of one of the basic principles of teaching in the classroom - the obvious. Based on the above research and analysis of foreign experiences, in terms of pupils can sistematize some advantages of e-learning: a) simplifies the significant distribution of data required for learning, but also other important information. Users of e-learning (students and pupils) can access these materials from the site and the time that best suits them, for example: at home, at college; b) Fast adjustment of pupils to this type of learning. With these solutions, students are not afraid to be wrong but feel free to explore and test all solutions, but unlike classical learning with an instructor, where there is often a fear of failure; c) the individualization of learning. The pupil can follow or material at the pace that suits him, a dynamic that suits him, and in a way that adapts itself. There is no burden that exists in classical learning, where the individual must adapt to the group; d) high motivation of pupils and memorising of teaching contents of the visual, multimedia and interactive elements that significantly affect the

increase pupils' motivation to work on time. Perception of material in a manner that is in the pupils's awareness of a close game, affect the larger and longer maintenance level of attention, and better memorizing so treated courseware.

II. CONVENTIONAL AND COMPUTER DIDACTICS

Didactic is pedagogical discipline that studies the common problems and patterns of teaching and learning. Analogously to conventional didactics has lately been increasingly meet with the term "Computer didactic", which, starting from the known principle of traditional teaching, and relations establishes the legality of the electronic teaching [4].

Didactic principles are generally applicable rules and guiding principles that regulate the flow of teaching and learning in the classroom and beyond. These principles are not hierarchical but the correlative relationships, interlocking with each other and intersect. New scientific - technical solutions and their application in teaching and pedagogical knowledge and influence to new approaches to selection and classification of didactic principles. Didactic principles are the result of knowledge legality of the process of teaching and learning and their empirical verification and derived theoretical assumptions that these processes will be more efficient if there are respect for the following principles [5].

Several key principles for the functioning of electronic supported teaching are:

- E-learning orientation to teaching objectives - Strategies for teaching and learning in E - teaching should always be aimed at achieving the objectives of teaching. The objectives of teaching and learning must be precisely defined and operationalized, because there is a possibility of dispersion in the work and the necessary detailed planning and tracing the flow of teaching as a "scenario". If the objectives are set too broad, imprecise or inadequate under the terms of teaching should be corrected. Designing of e-learning must be in accordance with the purpose of the object, but also the creation of educational content geared towards age, cognitive abilities and interests of pupils.

- The obvious of teaching content - Creation of teaching materials in electronic form allows pupils that with as many senses perceived objects and phenomena of the external world. Digital generations suppose multimedia design information that can be quickly and easily reached. This is achieved by direct observation of objective reality or through visual aids. At a younger age obviousness is important because pupils do not yet have a broader and more systematic experience in sensory memory. Well, the obvious can not remain. Based on visual performance concepts aided computer simulation, for example, it is necessary for pupils to different teaching strategies to take thoughtful abstractions, and towards the formation of concepts. Taking into account individual differences among pupils, in accordance with the presumption of cognitive learning theory of "limited capacity" should be assessed that the number of sensory information required for the formation of an appropriate concept. This is exactly the reason for the involvement of teachers in finding such diverse educational software containing simulations and animations related to courses, not only in teaching computer science but also other subjects, especially natural sciences [6].

- Constructivist approach and learning by research - Hence, the basic setting of this principle is that in the process of teaching should ensure maximum pupil activities, both mental and physical. The term “active teaching” is increasingly present in pedagogical reality [7].

Under activity mean universal creative and self-activity that man creates the world around you and yourself. No work, no activities, therefore, the creation and development - self development. People learn better and develop when using the "head, body, heart, hands and feet." Activity in the process of teaching can be sensory, intellectual, verbal and practical. The precondition for activating pupils is internal and external motivation and organization of teaching time in which pupils come to discovering knowledge, and it can not provide them for granted, "God-given" solutions. In the process of the teaching in the classroom pupils are successfully activated forms of the pupils' cooperation in which developed horizontal communication (pupil-pupil), such as paired and group work. In the models of individualized teaching as programmed, seminars and lectures revealing activity of pupils achieved half-heuristic and heuristic strategies of teaching in which pupils work independently, raise hypotheses, solve problems, seek and discover the known and applied in practice.

In the educational computer software pupils activity is achieved by solving tasks based on the given instructions. Pupils need to build their IT knowledge processing the information received by building a sample ie. picture association to existing knowledge. It is need to create teaching conditions for the appropriation of the teaching contents happens not only mere reception, but also an active construction. This principle can be applied to other remaining principles; if the

"construction" is understood as (re) discovery, then it qualifies as a principle discovered learning. Another form is the principle of minimal help: teacher helps as little as possible, so that the pupil still much to do on its own.

III. METHODS OF WORK IN E-TEACHING

In the traditional division of the teaching method, according to the Poljak, teaching methods are grouped into three major groups: verbal-text, illustrative-demonstration and laboratory-experimental. Individual or combined teaching methods and instructional information in them the basics of teaching the teachers' organizations, and largely in formation chart the pupils's way of learning and encourages psychological preconditions of successful teaching (motivation, attention, memory). However in recent times are increasingly talking about cybernetic teaching methods, as well as the previous amendment. Growing up with the constant presence of technology has made it come to increasing "gap between the generations".

Children have "multiplied" methods of communication, interactions, processes, income, perception and information processing, and therefore learning. In order to achieve effective teaching is necessary and it is better to say imminent intention to accept changes of teachers and the education system in general, and the formation of positive attitudes towards the integration of technology into teaching, and acceptance of the e-learning. Methodical bearers of the idea of e-learning are systematic development of educational technology, and its blending with teaching materials and educational objectives of teaching integrated into one unified whole.

Take, for example, a group of verbal-text method, and its most frequently methodical detail - storytelling. Very present in our educational system-applied at the time in the frontal form of work in the processing of new materials. The goal of the communication of 1: N, and the teacher exposing the material has to be very active, whereas the activity of the pupils minimized, or by the teacher may involve the learners in their own, and create discussion as a new methodical detail, thereby increasing the attention to the time and achieved some level of interaction with the pupil.

Digital storytelling is a combination of classic storytelling and digital media such as images, sounds and other media, making from the verbal-textual, illustrative-demonstrative methods, which are more dynamic, and more preferably in pupils. The studies that have been done have shown that digital storytelling include numerous positive outcomes of such classes such as intensive skills development, focused development and permanent learning notions in the minds of pupils, more memory and identified by learning through research, where the pupil is actively participating in the creation of their knowledge systems [8].

In the above mentioned studies indicated the 7 elements of the digital lectures:

1. The idea - which has to be routed through the entire course of the presentation,

2. The key question - setting problem,

3. The emotion, the emotional content of which is formed with pupils,

4. Participation of teachers leather narrator or guide through the story or presentation,

5. Pleasant atmosphere and environment,

6. The balance of visual and audio information,

7. The mechanism of keeping attention.

IV. PEDAGOGICAL COMUNICATION IN E-LEARNING

Communication is a dynamic process in which a man is consciously or unconsciously familiar with the knowledge of the second through the material used or the fact symbolic paths. [9]

Communication has three essential qualities:

- Communication is a process to establish a relationship between people - all kinds of connections, conscious or unconscious,
- Communication is the activity - the man is constantly active in communication,
- Communication is taught - human being learns to communicate, human is learning how to communicate in order to satisfy their needs, the person is active in communication [10].

Communication is a dynamic process made of the elements and activities that are equally important are interdependent and complementing. Communicative act is a conscious process motivated and aimed at achieving certain objective. Secondary objectives are unaware of, and that the wishes and intentions of the communicator. The goal of communication is the influence on interlocutors (for his feelings, emotions, and actions). If we do not achieve the goal, there is no communication. The impact can be conscious or unconscious, pleasant or unpleasant, positive or negative. Pedagogical communication involves communication in the teaching process, and the quality of teaching

communication depends largely on the efficiency of achieving educational objectives of teaching.

The key moment of success in the learning process lies in the degree of achievement of the objective of communicating between the factors in teaching: teachers, pupils and teaching content (didactic triangle), and educational technology (rectangle). From successfully realized complex communication, achieved working atmosphere in the school setting, ways of organizing communication and realization of the objectives of communication depends on the overall performance the most organized teaching as a form of education.

Key segments of effective teaching of communication comprises:

- The ability or competence of the sender to convey the message effectively implemented or the content of communications.
- The ability or competence of the recipient to understand or take the message or the content of communications.
- Effective communication feedback.
- Removal of noise or distractor [11].

The process of communication in the modern education includes all the elements of didactic quadrilateral: teachers, pupils, facilities that are exchanged and educational technology - ie communication channels or media. Communication in education has two basic content components: (1) information and a cognitive component, and (2) social and emotional component.

A pupil from each of these areas has specific information needs, receive and interpret both categories of information and then react to them, and sends that information to others. With regard to the communication channels used, the messages that are exchanged between participants of communication in the classroom can be verbal (spoken and written word) and nonverbal (tone of voice, facial expressions, gestures, posture and movement, objects that people use, aesthetic dimension of teaching material behavior in time, etc.). Furthermore, in every communication "emitter" teacher reveals something about himself, talks about his relationship with the caller and tried to influence him in different ways. Communication can be a one-way and two-way. Publication of the text or content on the web, as well as broadcasts on radio or television, without contact with the recipients are examples of one-way communication. On the other hand, conversation, communication in a group and learning in the classroom are examples of two-way communication because the participants mutually send and receive verbal and nonverbal messages.

Communication channels corresponding modes of sensory massage (visual, auditory, tactile, etc.), The types of messages (linguistic / verbal and nonverbal communication) and the media for their transmission that can be natural (eg, voice, facial expressions, etc.) And technical - in particular situation, computer. Communication takes place by means of sending and receiving messages. Teacher sends information and receives them from the participants, and the participants are not only the recipient, but the sender information. Feedback or feedback showing how some information sent to and accepted by the recipient interpertirana - students. Feedback is very important because they allow you to control the process of messaging and interaction among participants. The basic principle of communication in education is that the sender needs to adjust the message to the recipient.

To customize the message to the recipient, usually uses the term information filters that can be the following types:

- perceptual filter conditions that the attendant of teaching intercepted by different sensory channels and in what manner (e.g., with regard to attracting attention, readability of the content, aesthetics, etc.).
- cognitive filter is determined by the extent to which participants understand information that they lecturer / instructor present;
- emotional filter affects what learners feel and experience regarding information obtained during classes;
- asociacion filter is associated with the so-called free associations concerned with the trainees may arise regarding certain information.

In addition to filter information, communication is influence by "noise" in the communication channel. Noise can occur in designing messages (eg, slurred, unintelligible or ambiguous messages) during its transfer (loss of parts of the message, interfering signals and information) as well as receiving messages. In teaching communication are important concepts of authoritarian and democratic communication, as well as the concept of communication climate. Authoritarian communication as a rule consists of using the superior position of power or influence lecturer / instructor who determines which content and how pupils should adopt.

Democratic communication is characterized by respect for the personality, interests and independence of teaching attendant, the possibility

of mutual influence, the adaptation of teachers / instructors needs and desires of students, the ratio equals, developing a democratic culture in the relations between the participants, encouraging pupild to express their opinions and make proposals, as well as listening and respect for other participants. Communication climate is the general atmosphere in which communication takes place during the educational process and may vary according to the experienced and manifested a sense of freedom of expression, openness and honesty, warmth and acceptance of others, interpersonal relations, etc. the level of cooperation.

In modern teaching there are more functions performed by the teacher and student at the same time:

- Procedural functions - in relation to the teaching aims, are taken into account and individual and group of consensus about the objectives of the preferred embodiments; share experiences, achieved a consensus on the necessary information to start; taking into account all the thinking, feeling, consideration of working conditions.

- Interpersonal functions - Harmonization of principles, norms of behavior during the communication. Animating individuals on the active participation, supporting these kind of pupils. Harmonization, and the insistence on the principle of compromise solutions. In short: the creation of an emotional working climate.

- Strengthening personality functions- self-knowledge, self-realization, self-actualization, and self-assessment. Diversity teaching method of communication is updated, modernized, and the attention of pupils increases accordingly. The concept of modern teaching means teaching model in which the teaching content presented to pupils in addition to traditional ways and through ICT. It is a basic requirement that is placed before the participants of the educational process, possession of a computer with a connection to the local network and the Internet. In terms of program support to be used in education via the Internet, commonly used so-called "courseware tools", which allow storage of educational content on the web server and their connection, communication among the participants of the educational process, learning management, and test their knowledge through a variety of tests, self-checking. Such a concept of teaching is based on the use of modern computer and communications technology, with special emphasis on interactive learning and adjustment needs of the individuals. Involves the use of multimedia materials, consultations with teachers, the flow of e-mails among the participants, the existence of forums, online testing and others. [12]

V. CONCLUSION

The advantages of this method of learning are: fast distribution; pupils across the Internet access these materials, it is possible to include hypermedia materials, service can be used by individuals or groups simultaneously, connectivity "linking", multimedia content, ease of recycling and publication of content, the ability to administer access interactive content and so on.

In didactic software theoretical knowledge acquired in learning programs that are simultaneously embodied tasks that refer to the application of knowledge and problem solving in the immediate social, natural, and technical realities. In this way, the practice becomes a sphere verification of theoretical knowledge, but also a source of new knowledge.

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The Effect of Web-based Classroom Response System on Students Learning Outcomes: Results from Programming Course

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Abstract - Knowledge and skills in programming are one of the in-demand professions in the 21st century global economy. But even though students on these classes remain passive. The purpose of this study is to examine whether the using of digital learning through web based classroom response system may actively involve students in process of learning. To do this we compare the effect of using two active learning techniques on students learning during the programming lectures web-based classroom response system and class discussion. In this study, a mixed method research was used. For the purpose of quantitative research, a pre-test/post-test method was used to assess learning outcomes and anonymous survey to evaluate students' attitudes toward their active engagement. To obtain the qualitative data, five open-ended questions, for each group (experimental and control group) were included in the survey. The conclusions indicate that digital learning through web-base classroom response system increase learning outcomes, facilitate learning of programming and positively affect students attitude toward programming course.

I. INTRODUCTION

Teaching programming has been facing numerous dilemmas ever since it was introduced to high schools. From deciding which programming language and which platform is optimal for learning, as well as what is the quantity of information that the students can acquire, to how to enable the students to solve practical problems through the forms of programming languages. In previous research on pedagogical practices in programming education, researchers find that the traditional way of teaching is no longer essential to students learning in programming courses and suggest the implementation of a teaching approach that involves delivering theoretical and practical content together in the lecture environment [1]. The rapid growth of information and communication technologies (ICT) influenced every aspect of our life. ICT equipment like various sort of computers, projectors, smart board etc. become an essential part of a classroom of the 21st century [2]. Its integrations in the classrooms opens new possibilities for the teaching and learning process. Technologies such as web-based classroom response system (web-based CRS) are getting more popular among teachers due to their effects on student learning performance [3]. In the previous studies, web/based CRS were compared only with traditional lecturing method regarding learning outcomes and students' attitudes towards their usage. For this reason, the primary objective of this research was to compare learning outcomes resulting from the use of two active learning methods: web-based CRS and class discussion and to examine students` attitudes towards their active engagement during programming lectures. For testing the significance of the obtained results t-test was used.

II. BACKGROUND AND LITERATURE REVIEW

Knowledge and skills in programming are one of the in-demand professions in the 21st-century global economy. That is why so many young adults recognize programming as a promising profession. Learning to program is difficult and programming courses often have the highest dropout rate [4]. In some cases, these difficulties come from the inability of the teachers to teach these skills to the learners using only abstract concepts [5]. Basically, there are two main approaches to teaching programming. One approach is oriented towards problem-solving, considering programming to be an application of skills in problem-solving. Another approach is to base learning of programming in the context of code and system development [6]. There is no single answer which approach is better because different learners have different learning styles and needs [7]. According to [8]: "There are no single most powerful forms of representation, the teacher

must have at hand a veritable armamentarium of alternative forms of representation, some of which derive from research whereas others originate in the wisdom of practice". Many types of research investigate this topic during the past couple of decades, but there is still no consensus on what is the most effective way to teach programming. Most of the schools are using traditional way to teach programming which consists of lectures, take-home assignments and perhaps demo sessions where model solutions to the exercises are shown [9]. A review of the literature concerning courses in programming shows that among traditional methods of delivery of instruction, the lecture is more dominant in use compared to other forms of instruction. The problem with traditional way of teaching programming, is that learners are passive listeners. To overcome this problem educational institutions combine lectures and laboratory exercise in order to build learners skill-based knowledge. In [10] author states that learners should be given the opportunity to articulate their understanding and to construct the knowledge based on how the learner sees and understands the concept. In order to improve the classic lecture, interactivity between participants is a must. Teaching techniques affect the teaching. Incorporating new technology in process of teaching programming can increase teacher efficiency in the classroom and open up qualitatively different modes of classroom interaction [11]. Many types of research have been done showing the positive effect of using technologies in the teaching process and encouraging students to actively participate in process of learning programming [12]. One of the most frequently used technologies is computer based presentations. However, they have several limitations and one of the major is that its use could easily turn learning process into teacher-centered instead of student-centered. To overcome this problem many researchers suggested using additional technologies i.e. Computer Presenter, Smartboard or interactive whiteboard and CRS or Clickers.

III. RESEARCH PROBLEM

The main purpose of introductory programming course in high schools is to provide learners with basic knowledge of programming terminology and understanding of its usage in coding a program. Furthermore, such course includes an understanding of algorithms, data, programming codes and static concepts. For the beginners (learners with little or no previous knowledge), some concepts may be difficult to understand. Instead of continually applying the learned concepts in practical exercises, many beginners only do the actual practical tasks when the first formal assessment is required. In such situation the finer details of the concepts could be forgotten, resulting in their inability to successfully complete the assignment. Bed results could then lead to disappointment and disaffection with the course. However, the lecture is still the main method of delivering theories and new concepts in programming courses mostly because of efficient use of resources, fewer costs and access to the largest number of students. Many studies have criticized the traditional lecture format as it lacks interactivity, does not fully encourage active learning and does not take into account individual needs [13]. Other major problems include poor attendance and students' perception of lectures as boring, irrelevant and time-consuming [14]. Active learning approach takes into consideration the ability of the learners to acquire their knowledge through interaction. Furthermore, these techniques include exploring personal attitudes and values, engaging the student in critical thinking, and encouraging student participation through giving and providing feedback [15]. These strategies also encourage students to reflect on their experiences. Researchers have found active strategies to be more effective for retention of knowledge and student engagement [16].The question, "Do the digital learning through web-based CRS used during the programming lectures affect students' success and attitudes towards the course?" constitutes the problem addressed in this study, with its sub-problems listed as follows:

- Is there a difference with respect to students success between the experimental and control groups' regarding the use of active learning techniques?
- Is there a difference in experimental and control group attitudes toward their active engagement in programming lectures?
- What are the opinions of an experimental and control group of students following the intervention process (i.e. implementation of adequate active learning method)?

IV. METHOD

A. Design

A mixed method was used in this study to assess the use of active learning techniques during the class of programming. A mixed method design is an approach that combines both quantitative and qualitative research methods to understand a research problem. Its use provides comparative results, and increases the validity of the study [17]. For the purpose of quantitative research, a pretest-posttest method was used to assess learning

outcomes and anonymous survey to evaluate students' attitude towards their active engagement in programming lectures and overall satisfaction with the course. To obtain the qualitative data, five open-ended questions, for each group (experimental and control group) were included in the anonymous survey. Before data collecting, both the experimental and control groups were formed. Students and instructor in experimental group used free web-based CRS - Socrative, while the control group used class discussion as active learning technique. Teaching materials were prepared in advance according to each active learning approach. The learning objectives and task were communicated to both groups, the experimental group (EG) and the control group (CG). In experimental group the teacher prepared mini quizzes using web-based CRS that was used 15 minutes after the lecture started. In control group teacher used the same set of questions upon which he initiated class discussion. During the research phase, comparisons were made between the data obtained from the experimental and control groups, before and after the implementation in order to assess learning outcomes. The research was designed during the winter term of the 2015-2016 academic year. During that phase all necessarily measurement tools and parameters of research were determined. Data collection was performed at "Nikola Tesla" vocational school from Nis, Serbia, during the spring term of the 2015-2016 academic year and it lasted for two weeks. The students were informed of the intervention at the start of the spring term, but without revealing the purpose of the study. The sample includes students from two classes of the third grade enrolled to the programming in C# course. The students from one class were indicated as the experimental group (n=26), and the students from the second class (n=24) were indicated as a control group. Since an experimental design was conducted in the current study, no universe and sample group was created. Both classes were taught in the same semester, used the same textbooks, additional learning materials and had the same teacher. Learning outcomes were measured by taking the score on a test that was performed immediately after the lectures.

Both classes met once per a week for 90 minutes for the course lecture and question sessions. Each student in EG group has a smartphone with Android operating system. Web-based CRS - Socrative (www.socrative.com) was used to collect students' responses. Socrative is free software which only requires an internet connection and smartphones, and no additional equipment and expenses like clickers. Students in both classes attended the same lessons. During the first week, the topic of lectures was: "Defining and Application of Statistic Functions in C#". During the second week, the topic of lectures was: "Returning Parameters to the Main Program and Functions Side Effects". In each class, the teacher gives a lecture on selected topic and after the 15 minutes, he poses 10 questions related to the topic. Students in EG group uses Smartphone to give an answer to each question. Then teacher downloads all students` answers and reviews them. After that, he forms several groups of students whose answers were different and let them discuss their answers in the group for approximately 15 minutes. After that, the students answer individually the same questions again using web-based CRS but this time they had a chance to change their minds because they have listened to the arguments in the groups. After finishing the test the teacher collect their answers as posttest results. Finally, the teacher provides answers to the questions and resolves the doubts if they still exist. At the end of the lecture, students took a final test. In CG group after the 15 minutes of lecture the teacher gave the students a pre-test and asked them to write down the answers. After that the teacher collected the pretest and initialized class discussion based on students answers. In CG group during the class discussion teacher listened to students responses, asking them to elaborate on their thinking by providing additional explanations, and trying to include as many students as possible in the dialogue by addressing additional probing questions to less active students. After that, he gave them the same test. As in EG, students in CG also had a chance to change their answers. After finishing the test the teacher collected their answers as posttest results and provided answers to the questions and resolved the doubts if they still existed.

B. Data collecting and Processing

Data collection process lasted for two weeks. In this study, two data collection methods were used to collect the quantitative data. The pre-test/post-test method was used to evaluate the effect of implemented active learning techniques on students learning outcomes, and the anonymous survey was used to evaluate students' attitudes toward active learning techniques that have been used during the class of programming. In the survey, five open-ended questions, for each group (EG and CG) was included to collect qualitative data. The questions were: Considering the last 2 weeks – (1) What frequency would you recommend the professor to use the web-base CRS (for EG) i.e. class discussion (for CG) (always, more than now, with the same frequency, sometimes, but less than now, never. Explain)? (2) Have you felt more involved in this lectures by using web-base CRS (for EG) ¬/ class

discussion (for CG)? (3) Do you participate in collaboration with peer/class discussion? (4) Which were the obstacles that you had using web-based CRS/ during class discussion? (5) Overall, please rate your experience of this course compared to the previous way of teaching? The same test was used for pretest and posttest. It consisted of a various types of questions ranging from multiple choice questions, true/false to short answers. To measure overall test reliability a Kuder-Richardson formula (KR-20) was used. For final test KR-20 value was 0.78, its average level of difficulty was found to be 0.41, and its average distinctiveness was found to be 0.38. In order to evaluate students' attitudes toward active learning techniques that have been used during the class of programming, a survey was created. A survey used five Likert-type questions (five-point scale) and five open-ended questions for qualitative research.

V. FINDINGS

To evaluate the effect of using the selected active learning technique on learning outcomes in the classroom, learning outcomes were assessed, before and after the implementation of the active learning technique. Pretest scores from both groups were subjected to statistical analysis to ensure that both groups are comparable in their pre-class knowledge. The unpaired t-test was used to compare pre-test scores. The overall pretest score averages at the end of the second week, for the experimental group (who were using web-based CRS) and control group (who were using class discussion), are presented in Table 1. No statistical difference was found (p = 0.73).

TABLE I. PRETEST SUCCESS SCORES

Groups	No. of questions	n	$\bar{x}$	Std	*t*	*p*
Exp.1	10	26	52,342	2,97	0,32	0,73
Control	10	24	51,647	2,65		

*P>0,05

Results shown in Table 1 indicate that pretest score averages of both the experimental and control groups are close to each other, and there is no significant difference between the two groups' pretest scores (p>0,05). So, both groups are equal with respect to pretest scores. At the end of each lecture, both groups had a final test. The unpaired t-test was used to compare overall posttest scores at the end of the second week. The posttest score averages of the experimental group and of the control group are presented in Table 2.

TABLE II. POST TEST SUCCESS SCORES

Groups	No. questions	n	$\bar{x}$	Std	*t*	*p*
Exp.	10	26	78,297	5,67	3,537	0,002
Control	10	24	62,278	5,05		

According to results shown in Table 1 and Table 2, there is a significant increase in the success rates of both groups, but the greater increase is evident in the experimental group. So, it can be concluded that web-based CRS is more efficient that class discussion regarding learning outcomes. To evaluate students' attitudes toward active learning techniques that have been used during the class of programming a five Likert-type survey was created. Statements were: S1 - These technique helped me to transform myself from passive to the active class participant; S2- These technique helped me to be aware of my knowledge level; S3-These technique stimulated communication with my classmate; S4-These technique allowed me a better understanding of lecture; S5- These technique allowed me a better understanding of lecture. The results of students' attitudes are shown in table 3.

TABLE III. STUDENTS ATTITUDES

		S1	S2	S3	S4	S5
Strongly agree	EG	24%	15%	15%	15%	10%
	CG	3%	14%	9%	2%	7%
Agree	EG	67%	79%	76%	59%	68%
	CG	51%	62%	48%	52%	47%
Neutral	EG	2%	4%	8%	18%	12%
	CG	22%	12%	21%	23%	26%
Disagree	EG	4%	2%	1%	5%	7%
	CG	20%	7%	12%	14%	15%
Strongly disagree	EG	3%	0%	0%	3%	3%
	CG	4%	5%	10%	9%	5%

The great percentage of students from EG group agreed that web-based CRS helped them to become active class participants (91%), be aware of the level of their knowledge (94%) and allowed them a better understanding of lecture (74%). This technique also stimulated communication with a classmate (91%) and facilitated learning of programming (78%). Comparing to EG, 54% of students in CG agreed that class discussion helped them to become active class participants, 76% became aware of the level of their knowledge, 54% think that class discussion allowed them to better understand the lecture; 58% of students in CG think that class discussion stimulated communication with a classmate while 54% of students think that class discussion facilitated

learning of programming. For qualitative research five open-ended questions were included in survey. Student opinion regarding the first question: "What frequency would you recommend the professor to use the web-base CRS (for EG) i.e. class discussion (for CG) (always, more than now, with the same frequency, sometimes, but less than now, never. Explain)?" To assess the overall attitude towards the frequency of using proposed active learning technique, comments were read and each student answer categorised. The results are shown in Table 4.

TABLE IV. STUDENTS OPPINIONS

	Web-base CRS	**Explanation**
always	19%	it motivated me to attend class, it makes me free to answer, it was fun; it looks like game;
more than now	46%	opinions of classmates help me to understand lecture and learn new subject, its use engaged me during the lecture more than before, it is a good idea, I've become more active and had the courage to say something during talking to peers;
with the same frequency	27%	it takes more time when working in group
sometimes, but less than now	8%	give teacher more times to explain new subject
	Class discussion	**Explanation**
always	4%	it helped me to resolve my dilemmas
more than now	25%	the teacher saw our mistakes in the test and gave additional explanation, I realized my mistakes without exposing myself,
with the same frequency	42%	it let us argue, it helped me to learn better through dialogue, I learnt a lot during discussion
sometimes, but less than now	29%	I didn't understand lecture so I couldn't take part in discussion, it is difficult to me to say out loud what I think, not enough time to take notes

As it shown in Table 4, students have a affirmative opinions toward active learning techniques since none of them, in both groups, didn`t write down the answer: never. Students in EG recommended greater frequency of use than the students in CG. From these answers it can be concluded that positive effect upon using active learning technique occurred when students communicated actively to help one another to understand, get immediate feedback from teacher, and be able to answer the question anonymously.

VI. DISCUSION

According to the findings, when each active learning technique was introduced, the programming course became more attractive to students. Students learning outcomes were increased in both groups, but greater increase is evident in experimental group, where students used web-based CRS and smartphones, than in control group, where students used class discussion. As for students' attitudes towards the active learning technique used, there is a significant difference in students' attitudes in experimental and control group. Students that used web-based CRS found themselves more actively involved, more aware of their knowledge and better understood the lecture than the students that used class discussion. Furthermore, according to students' opinion, web-based CRS engaged them in collaboration more than class discussion. Regarding the third sub-problem of the study students have very affirmative opinions of using active learning technique in comparison with traditional way of teaching. The written comments revealed that students in both groups agreed that active learning techniques increased their attention to the lecture, enhanced interaction during the learning process and provided students immediate, real-time feedback. Students were also found to believe that collaboration with peers is important because it can broaden their personal understanding and enable them to be more active. But there is significant difference between these two active learning technique, web-based CRS and class discussion in context of students' active participation. Percentages of students actively involved in class discussion are less than other once This leads to the conclusion that class discussion didn't manage to involve all students in the discussion and those shy, unsure of correct answer or less motivated students and students who take more time to compose an answer stayed resistant. On the other hand, web-based CRS enables all students to give their answers to questions independently and anonymously. As a result, a student that otherwise wouldn't be involved in learning becomes an active participant. This is consistent with the findings of [18], who found that web-based CRS and Smartphone's are feasible tools that can facilitate active learning in classroom and increases the level of student participation. It can be concluded that students that used web-based CRS appreciated ability to stay anonymous, not to expose themselves and not to be humiliated in case of giving a wrong answer. Despite the desire to stay anonymous, students like working in group. They tend to remember lectures that require interaction with peers. The written comments also suggest that some students prefer the teacher to evoke the correct answer rather than be engaged in conversation and confront their own misconceptions with those of peers. It seems that

for all those students pointing out to misunderstandings hardly made any sense. They expect more feedforward from teacher in order to understand complex topic in programming. According to [19] students need their professor's feedforward to improve their learning process and increase quality of education.

Some limitations should be considered when interpreting the study's results. One limitation here is the size of the classes in the sample. The sample size in this study was 50 students from two classes. There is a requirement to repeat this research in larger groups. A second limitation of the study is short period of two weeks. Future work should explore attitudes of students who have used web-based CRS and class discussion over a longer period of time (over, 1 or 2 years) to see whether these have changed over time. This study supports researches cited earlier in this article, in suggesting that both web-base CRS and class discussion can be a very useful tool in delivering pedagogical outcomes, such as classroom engagement, involvement, participation and enjoyment. From the students perspectives, web-base CRS has some added value since it enables students to stay anonymous so there is no humiliation in getting a question wrong. It is possible that more positive attitudes towards web-base CRS than to class discussion could lead not only to students' greater involvement, but also to better learning outcomes for students, but this has not been firmly established by research.

VII. CONCLUSION

Several conclusions can be drawn from the results of this research. First, after introducing these active learning techniques students' learning outcomes increase, but better learning outcomes were recorded in group that used web-based CRS than class discussion. Students welcomed the idea of becoming more actively engaged in lecture, because the understanding of lecture increases, they become more aware of their knowledge since they get immediate, real-time feedback. Students agreed that these active learning techniques facilitates learning of programming, but their attitude toward web-based CRS are more affirmative compared to class discussion, since this technologies evoke positive emotions and enables students to answer to questions without exposing themselves. Further research is required to determine weather these positive attitudes towards digital learning could lead to better learning outcomes and more active engagement in programming lectures.

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Tangible user interface for pre-school children learning

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Abstract. New information technologies are giving rise to new possibilities in education even for the youngest. The use of innovative methods in education has the potential not only to improve education, but to generate interest in various areas, and to motivate children to learn better since they use multiple sensory modalities. The concept of tangible user interface (TUI) seems the ideal solution for preschool children. This paper presents the development and evaluation of an interactive educational game that uses tangible user interface. The application allows children to learn the characteristics and differences between animals, on a simple and easy way. They are able to manipulate the digital information by selecting and positioning physical object, representing the various animals. Developed application is augmented with the QR codes which enable the system to detect selected animal. The developed interactive educational game was evaluated with children in one kindergarten, and the results are presented in this article.

I. INTRODUCTION

Technology development and daily use of computers and mobile phones, have a strong impact of non-formal education. Various education materials, applications, and even games, can be used in learning process [1, 2, 3]. For the youngest games are the ones that most attract their attention, considering the fact that they are interesting and fun. But at the same time educational games can improve their cognitive skills [4], concentration, perception, ability for decision making [5], motor skills [6], social and emotional skills [7]. Playing games is essential for a child's development and for learning life skills [8].

One of the emerging research fields in human–computer interaction (HCI) is concerned with finding a new ways of interaction that aim to provide a more seamless bridge between the physical and digital worlds. Tangible user interfaces (TUI) aim to give physical form to digital information, employing physical artefacts as representations and controls of the computational data [9, 10, 11]. TUI can be seen as an alternative to GUI (Graphical User Interface) to allow direct manipulations: children will be able to control the system by selecting and positioning physical objects [12]. Games are especially prolific in putting into practice the TUI paradigm, giving rise to a new generation of games which combine traditional physical playing based on the manipulation of toys, with the new possibilities of digitally augmenting the player's area with computer images and audio feedback [13, 14].

This paper presents the design and evaluation of an interactive educational game, called Animals world that uses tangible user interface. The application allows preschool children to learn the animals and their characteristics, through fun and play. Children used physical object (animals) to manipulate the relevant digital information. The developed application is augmented with the QR codes [15] which enable the system to detect selected animal.

In order to investigate the application's acceptance and its impact on children's motivation for learning, the Animals world application was evaluated in real case scenario on a selected set of test users. The results of the evaluation have shown that this method of learning is interesting and at the same time fun and motivating for children.

II. ANIMALS WORLD EDUCATIONAL GAME

Many children learn animals by watching cartoons, collecting albums with stickers, browsing books with pictures of various animals and playing with musical toys that imitate the animals' sound. Motivated by these ideas, we have decided to create an application that will allow children to learn animals, in a fun and interesting way. The application is designed as an interactive educational game that uses TUI for supporting children's play and learning. It has a simple, but colorful design, enriched with interesting characters of animals that attract children' attention.

Background music and sounds are also important part of the game. Background music can be turned on or off, with a help of the button design to be visually meaningful for children,

while the sound emitted by the animals can be used to identify the displayed animal.

The first screen of the game shows three menus that can be used for choosing different kinds of animals: domestic animals, wild animals and both (Fig. 1).

Figure 1. Start menu

After selecting one of the offered menus, the animals of a chosen category appear, on a left side of a screen, one by one. The user can recognize animals by their appearance and sound, and can give the answer by selecting the appropriate physical toy from a set of available toys. Each physical toy has a QR code set on an underside of the toy (Fig. 2). [1]

Figure 2. Toy and QR code

The user needs to put the toy with the QR code in front of the computer camera so that it can be detected by the application. The QR code actually connects the physical world (toy) with the electronic (developed application), thus facilitating communication between the children and the computer. The application reads the QR code and interprets it in a form of an answer. If the answer is correct the user gets 1 point. If the answer is incorrect the user has another chance to answer. If the answer is incorrect in the second attempt then the user doesn't get any points. During the game, the user receives notification for correct and incorrect answers, visually and with sound. The number of earned points are shown at the top left corner of the screen, during the game (Fig.3).

Figure 3. Screen from Animal World application showing the incorrect answer (the selected QR code doesn't correspond to the displayed animal)

When the game is completed, the player can see the total number of earned points as well as incorrect answers, so he/she can put more attention to these particular animals next time. If the player is not satisfied with the result there is an opportunity to play the same game again.

Using points increases the competitive nature of the application, which positively affect users' motivation and engagement [16].

III. EVALUATION

The system usability was evaluated from the end users perspective. The evaluation was conducted in one kindergarten, where a total of 25 preschool children (12 boys and 13 girls) from 4 to 6 years were participated. The children were familiar with the animals and their characteristics. All of them also had some experience using computers.

The experiment was conducted in two steps: training phase – when the evaluator explained the rules of a game, and shows how the game is played, and testing phase – when the actual experiment was conducted.

All children were playing a mixed menu consisted of domestic and wild animals. Time needed for completing the activity (during the first and the second trial), as well as number of correct and incorrect answers (in both trials) were recorded.

To evaluate the system usability we used the well-known System Usability Scale (SUS) questionnaire. The SUS was developed by Brooke in 1986 as a tool for usability testing and has been

[1] QR (Quick Response) code is a form of two dimension bar code that can be read on devices such as a mobile device or a computer which, once accessed, will allow you to complete an action.

used extensively in evaluating user acceptance of various systems. Prior studies have shown that the SUS provides a good and valid method of assessing interface usability [17].

The SUS is a simple, ten-item scale that evaluate users' impressions about the system and their degrees of satisfaction. It uses 5-point Likert scale anchored at 5 = strongly agree and 1 = strongly disagree. Because the participants were preschool children we have used a smileyometer scale (Fig. 4), which is considered to be more acceptable for this age group.

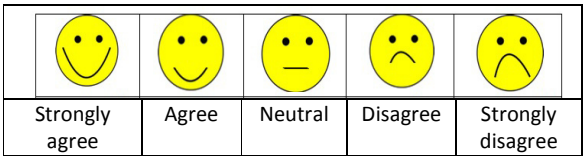

Figure 4. Smileyometer rating scale

The SUS questions elucidate the complexity, functioning, ease of use, self-efficacy, and difficulty level associated with operating the system from the user's perspective. To minimize bias based on agreement or disagreement, odd-numbered items of the SUS questionnaire are given more points for strong agreement, and even-numbered items are given more points for strong disagreement. After users finishing answering the questions, the scale offers a formula which transfers the subjective impressions of users into the objective data information for analysis. The range of possible values is from 0 to 100. The higher the score is, the more useful the system is and the more easily users can interact with it [18].

IV. Results and Discussions

Results obtained during experiment were summarized and processed during the phase of data processing. The mean value and standard deviation, for both trials are shown in Table 1.

From the results, it can be observed that children need less time for completing the level in the first trial, but the error is greater in this trial. During the second trial the time for completing the level is longer, but the error is smaller, which indicates that the children pay more attention during the second trial. This again indicates that the children are engaged and motivated during the play.

TABLE 1. QUANTITATIVE DATA FOR BOTH TRIALS

No	Time (minutes:seconds)		Correct		Incorrect	
	First trial	Second trial	First trial	Second trial	First trial	Second trial
1	05:25	05:38	8	9	2	1
2	04:15	05:12	9	10	1	0
3	04:37	04:22	10	10	0	0
4	05:29	04:45	9	10	1	0
5	04:34	05:10	8	10	2	0
6	05:11	04:49	10	10	0	0
7	04:10	05:11	10	10	0	0
8	04:26	04:32	9	10	1	0
9	04:47	05:11	9	9	1	1
10	05:33	05:47	10	10	0	0
11	04:44	04:54	10	10	0	0
12	05:09	05:11	9	10	1	0
13	04:50	04:25	10	10	0	0
14	05:10	05:05	10	10	0	0
15	05:15	05:18	8	9	2	1
16	04:24	04:36	10	10	0	0
17	05:25	04:25	10	9	0	1
18	04:12	04:25	10	10	0	0
19	05:15	05:41	9	10	1	0
20	04:10	04:45	9	10	1	0
21	04:17	04:42	10	10	0	0
22	05:15	05:37	8	9	2	1
23	05:32	05:23	9	10	1	0
24	04:44	04:58	10	10	0	0
25	05:01	05:15	9	10	1	0
Aver.	**04:52**	**05:00**	**9,32**	**9,8**	**0,68**	**0,2**
St.dev.	**0,01972**	**0,01783**	**0,74833**	**0,40825**	**0,74833**	**0,40825**

To see who has better results by gender, boys or girls, we made a sample t-test assuming unequal variances. Results from this test shows that p-value is less than α (p=0.00046; α=0.05), which means that there is statistically significant difference between the means of two data sets. Thus, we reject the null hypothesis which stated that there is no difference between boys and girls performance, and accept the alternative hypothesis which stated that girls perform better than boys.

Once all participants have finished the game, they fill out the SUS questionnaire. The results showed that the SUS score is 74.87 (which is above the average of 68) with a standard deviation of 9.88. The SUS scores ranged from 62.5 to 92.5. SUS scores were classified into four major categories: exceptional (scores in the 90s or above), good (scores in the 80s), acceptable (scores in the 70s), and minor usability issues (scores below 70).

On the basis of this classification, 16 percent (n=4) of the study participants had exceptional usability scores, 20 percent (n = 5) showed good scores and 36 percent (n=9) showed acceptable scores, while 28 percent (n=7) had a minor usability issues.

TABLE 2 RESULTS FROM SUS QUESTIONNAIRE

Candidate No	SUS Result
1	80
2	77.5
3	82.5
4	67.5
5	62,5
6	77,5
7	70

8	75
9	62,5
10	70
11	82.5
12	65
13	70
14	70
15	92.5
16	82,5
17	62.5
18	92.5
19	82,5
20	62.5
21	92.5
22	92,5
23	75
24	65
25	70
Average	**74.87**

From the results, we can see that this kind of interactive interface is well accepted by children. Using TUI as an interface for this game gives a new dimension to the game, making it very interesting and novel. Anyway, there are still some directions for improving the application. Participants commented that the game would be more interesting and challenging if they were more animals included in each of the groups. Some rare animals should be also included, in order to keep the attention of older children, because the game was too easy for some of them, and they were not willing to play the game after second trial. They said that the way of interaction is interesting for them, but they would like to play a game that would be more complicated and would require more mental effort.

V. CONCLUSION

It is commonly believed that physical action is important in learning. TUI used this concept to increase the engagement and motivation during the learning process. Tangible objects, used during TUI interaction, are thought to provide different kinds of opportunities for reasoning about the world.

Guided by these findings we have developed an interactive educational game that uses tangible user interface. The application allows preschool children to learn the animals, their characteristics as well as sounds they emit. The application was evaluated in one kindergarten. The results revealed that children have a positive impressions about using physical object for interacting with the game. They also said that the game is very interesting, useful and easy to use, and they wish to continue to learn through play.

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Preferable E-learning Tools – an Action Research

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Abstract – This research shows comparative analysis of preferable e-learning tools according to students' opinions and according to data from Centre for Learning and Performance Technologies (C4LPT). Results show differences and similarities between the two mentioned researches. Future work is related to further analysis in this field.

I. INTRODUCTION

According to the American Society for Training and Development (ASTD, [1]) e-learning is defined as a broad set of applications and processes which include web-based learning, computer-based learning, virtual classrooms, and digital. The definition of e-learning depends on the organization and how it is used. It includes electronic communication, education, and training.

E-learning tools and technologies are used to improve the quality of learning content. These days' e-earning tools besides computers include MP3 players, podcasts, blogs and more.

Net generation students are well known in technology and e-learning tools. They enroll faculties with developed communication by text message, e-mail and message board and armed with laptops, MP3 players, smartphones and PDAs. Usually, they have experience with online social networks, blogging and downloading music and video. Many authors emphasize the importance of the opportunities provided by Web 2.0 technology to create and share the content and to interact with other users [2, 3].

The influence of introducing e-learning tools on the results of students at the progress test was analyzed by Moravec et al. [4]. The research gave results which show positive influence of using e-learning tools on the results of students. Bearing in mind those results, it is very important to detect preferable e-learning tool for every group of students. E learning tools also affects other skills. The possibility of Improving Managerial Strategic Thinking Skills with use of e-learning tools was presented by J. Simuth [5]. Research conducted by Pinto-Llorentea et al. [6] brings some light on the students' perceptions towards the effectiveness of asynchronous tools (podcast, video cast, online tests, online glossary and forums) in teaching English grammar to foreign language learners. Blagojević and Papić also investigated in detail the implementation of Facebook for e-learning [7]. They concluded that Facebook should definitely be used as an e-learning tool in the process of teaching because 96% of surveyed students (out of 113) are members of groups where they discuss issues regarding their studies, and they prefer communicating through those groups and they do it on a daily basis.

At the Faculty of Technical Sciences in Čačak, more than 100 courses within Moodle LMS [8] and Office 365 [9] are developed. Courses are developed to include preferable e-learning tools and motivate students in learning. The main idea is to apply students' well-known and preferable tools and technologies in learning.

Goals of this research are to investigate which e-learning tools are preferred by students of our Faculty and to compare the results with results of Centre for Learning and Performance Technologies (C4LPT, [10]).

II. CENTRE FOR LEARNING AND PERFORMANCE TECHNOLOGIES (C4LPT) REVIEW OF E-LEARNING TOOLS

Jane Hart set up the Centre for Learning and Performance Technologies (C4LPT) in 2000. Since that time it has become one of the world's most visited learning sites on the Web. In 2016 there were over 2.4 million visits viewing over 10.5 million pages. It now contains a number of key resources and comprises a number of complementary websites which you can access via the links at the top of the page.

This Centre categorized all tools in four main categories:

1. Instructional tools

- E-Learning Authoring Tools

- Quizzing & Testing Tools
- Learning Platforms & LMS

2. Content development tools

- Documentation tools
- PDF & Flipping Book Tools
- Presentation Tools
- Spreadsheet Tools
- Clip Art, Image & Photo Tools
- Graphics & Info graphics Tools
- Screen capture & Screen casting Tools
- Audio & Podcasting Tools
- Video & Animation Tools
- Blogging Tools
- Web Page/Site Tools
- Forms, Polling & Survey Tools

3. Social tools

- Email Tools
- Messaging Apps & Chat Tools
- Discussion Forum & Web Chat Tools
- Audience Response & Backchannel Tools
- Webinar & Webmeeting Platforms
- Social & Collaboration Platforms & Spaces
- Other Sharing & Collaboration Tools
- Public Social Networks

4. Personal and professional tools

- Personal Learning Management Systems/ Spaces
- Search & Research Tools
- Curation & Social Bookmarking Tools
- Notetaking & PIM Tools
- Mind mapping Tools
- Journaling Apps
- Personal Productivity Tools
- Personal Dashboards
- Players & Readers
- Browsers and Extensions
- Personal Devices

Figure 1 shows the top 30 tools for e-learning according to Centre for Learning and Performance Technologies (C4LPT) [10].

Figure 1. Top 30 tools for e-learning [10]

III METHODOLOGY

This research was conducted at Faculty of Technical Sciences in Čačak. Participants were Technics and Informatics 4th year students (future professors of Technics and Informatics). Table I shows the structure of participants according to the gender.

TABLE I. STRUCTURE OF PARTICIPANTS

Gender	Count	**Percent**
Male	13	**59.1**
Female	9	**40.9**

Every student was asked to choose the most and the least prefereable e-learning tool from all the tools which they are familiar with. They could also use the list shown in figure 1. Then, we preformed comparative analysis of the results with the results obtained by C4LPT [10] which are given in Figure 1.

Regarding the number of students which is less than 30, this reasearch is within action type. Action research involves actively participating in a changing situations, often via an existing organization.

Results of researches like this one should affect teaching process and work with students. Results of this particular research will certainly affect the choice of e-learning tools in future work.

IV RESULTS

Students opinions about the least and the most prefereable e-learning tools are given in Table II.

TABLE II. REVIEW OF THE MOST AND THE LEAST PREFERABLE TOLLS

The most preferable e-learning tool	Number of participants	The least preferable e-learning tool	Number of participants
YouTube	11	Wikipedia	11
Google search	7	Facebook	10
Moodle	2	Moodle	1
Wikipedia	1		
Scribd	1		

Most of them think of YouTube as the most preferable e-learning tool, while on the other hand, they consider Wikipedia as the least preferable one.

V CONCLUSION

Bearing in mind given results we could conclude in several ways:

- The most preferable tool for e-learning is YouTube and it is the same in the research and results from [4] Centre for Learning and Performance Technologies (C4LPT);
- Wikipedia is on the list of top 30 tools for e-learning (11th place), but our students evaluated Wikipedia as the least preferable tool.
- Results show the need for future research for every generation of students with aim to determine the most preferable e-learning tool. After results of action research the teaching should be improved according to results.
- Results from this particular research encourage us to think about making some videos of our lectures and tutorials for exercise and put them on a YouTube channel.

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The Importance of Dual Education and its Representation on the Territory of Middle Banat

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Abstract - As technological changes are very rapid it has become more and more necessary to transfer parts of practical and professional training to a great number of companies that represent the essence of dual education and vocational advanced training. It is necessary to implement, innovate, and carry out the dual education system in the state educational system. Cooperation of economy and school institutions represents the master key of success. With the support of the state institutions in order to implement such a manner of education, a synergistic effect on the overall system will be achieved. Taking into account the fact that now on the territory of Serbia a focus has been putting on the system of introducing dual education and that it has become today's imperative, writing this paper has become inevitable. During the era of very successful cooperation between the Technical faculty "Mihajlo Pupin" and the local self-government if the city of Zrenjanin, as well as the economic circle, it is necessary to point out the importance of introducing such a system in this county. The research work was carried out on the territory of Middle Banat and it refers to the representation and importance of introducing the dual educational system on the territory of this county.

I. INTRODUCTION

The basic goal of introducing dual education is to help schooling system to educate personnel that are really required by the industry and economy. The main signification of introducing such a curriculum into the school system is reflected in motivating both students and economic entities in order to employ only qualitative personnel. As advantages of introducing dual education we can quote better work result, wealth of diversities and dissimilarities, work skills improvement, higher satisfaction, increased working discipline, more effective decision making, as well as improved communication and awareness as students as economic entities. Introducing such a system it is necessary prior to form a strong and effective expert team. The work of any member of the team contributes to the utmost performance and any member of the team is responsible equally for the result of their common work [1]. Need for teamwork appears at complex assignments that an individual person could not realize or at assignments that require various abilities as well as various knowledge. At the end of 1970s and at the beginning of 1980s, two special researches came to identical conclusions. A group of researchers studied the Japanese breakthrough to the west with the aim to identify the reason of success of many Japanese companies on the export market Another group of researchers had aim to research how it is possible to rejects the Japanese companies' breakthrough onto the USA and European markets. Both teams' conclusions encompass the team work along with cooperation with universities was the bases for faster development of new products and continuous improvement of quality and productivity of economic. Nevertheless, the conclusions pointed to some organizational scheme in order to achieve development of broader functional corporation and to more programs for corporative culture change [2]. At our faculty, the system of dual education has been developing in two strategic ways. Focus is put on realizing projects through vocational practice in industry. A positive example is cooperation with the local self-management on the sectors of IT. Students' projects are also an important aspect of dual education. The Technical faculty "Mihajlo Pupin" is very successful in the area. It organizes six international conferences in which a wide scope of scientific fields is taking part (Picture 1). Analyzing numerous references, we have come to researches that had been carried out in the European countries. We also get to know that their government systems advocate greatly introducing dual educational system in their school system. The research conducted in Germany points out the importance of vocational education and training. Vocational education is available for any young people no matter of their qualifications. 25 per cent of interrogated pupils gave positive answer regarding the graduating pupils in this country after completing basic circle of education chooses vocational high schools in. The German model of education points to the importance of introducing one of these systems

that represents bases for successful built out carrier. [3]. The research carried out in Austria is also interesting where the importance of this system and advantages of its introduction is pointed out. It is connected to economic sustainability of the state system. Austria together with Germany and Switzerland during the last couple of years has faced expansion in the education system that can be tightly connected with eh increased unemployment of young personnel. However, the industrial entities of these countries adjust very hardly to dual education system. Really, the Austrian dual educational system is in its developing phase as well as in many other countries in transition. It is believed that the introduction of this system will increase greatly in many educational segments during the coming period both in Austria and in other countries. [4].

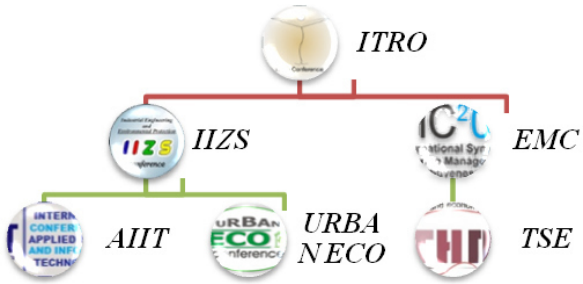


Figure 1. Students' projects as aspect of dual education

II. Subject and Problem of Research

Dual Education system brings series of advantages on its path to achieve the set goals. It enables connectivity of vocation and science on satisfactorily precise, innovative, competitive, and focused manner. Conducted by vision and ambition the desired result is achieved. Introducing such a system double effect is accomplished. The student gets practical training at a company that he or she completed with theoretical knowledge. It enables linking theory and practice. This research presents examples of cooperation of school systems and industry. As a problem it can be noticed that there has been conducted a small number of research related to dual education on the territory of Zrenjanin. As well as, it can be noticed that there are little information related to this topic and current state of dual education on this territory.

III. Field and Mannaer of Research

The research was conducted in the city of Zrenjanin, the administrative center of Central-Banat County. There are 76.511 inhabitants in the City of Zrenjanin, while there are 123.361 inhabitants on the territory of the county. The total surface of the district is 1.324km^2 [3]. A questionnaire was used to collect data. It was underlined that it was an anonymous one while the results would be used exclusively for research work. The poll was conducted in February and March 2017, and we have got 75 filled in questionnaires. Taking into account the complexity and variety of jobs on the territory of a city, we tried to include many people and to gather data from more and more tested people. The research work included industrial entities, school institutions, local self-government, as well as participants in the summer vocational training that is also a very important segment of dual educational system. The examinees' opinions were assessed according to the Likert scale. The applied scale represents a five-level scale by which the examinees expressed their level of agreement or disagreement.

IV. The Goal of Research

The goal of such a research is to present the main economic success of a state system. It is necessary to point out such an approach that brings inventiveness in the overall state system. The purpose is to integrate young people into working force that will effectively show outstanding results in assignments they will carry out. Really, the goal is to find the ring that will bind companies with pupils and students. It is necessary to find solution and answer acceptable by all parties present in dual educational system. The idea of the paper itself is to motivate all entities to take part in this system precisely on the territory of the City of Zrenjanin.

V. Hypotheses of Research

The main hypothesis: There is a positive attitude towards dual education and its representation of application on the territory of Middle Banat.

Hypothesis 1: Cooperation of industry and school institutions represents the master key of overall state system success.

Hypothesis 2: Dual education brings qualitative personnel that care about the development of business skills together with constant advanced training and advancement.

Hypothesis 3: Introducing such a system brings results in increased varieties and dissimilarities in companies and school institutions, and later on noticeable advanced training results in industry.

Hypothesis 4: Introducing dual educational system on the territory of the City of Zrenjanin general progress and surrounding development are achieved. Thus, an impetus is given and by

motivating young people to stay in the city where they live and develop it.

VI. RESULTS OF THE RESEARCH

The main hypothesis was proved by sub-hypotheses, while each sub-hypothesis was proved by their own questions. The connection between sub-hypotheses and their questions are given in Table 1. Results of research are illustrated in Table 1, and in Figure 2. In Table 1 the sub-hypotheses are given, their questions (P1-P10) and percentage of answers to each of the noted questions. The Figure 1 present the examinees' from Table 1 answers graphically.

First hypothesis relates to cooperation between industry and school institutions and successful cooperation is considered the master key of success. The examinees highlighted the introduction of dual education system decreases unemployment. This statement has been confirmed by 47% of examinees, while 36% have agreed completely with it, and a very small number of examinees have not agreed partly of completely with this statement. (9% and 3% of examinees). Only 5% of examinees were undecided. It is very important to emphasize that introduction of dual educational system has positive effects on the governmental system. The questioner has shown that 52% of examinees have agreed with this statement, among which 23% agreed completely, (7% and 9% of examinees have not agreed completely of they have agreed partly), while the rest of the examinees pointed out neutral attitude. 36% of examinees confirmed completely that today secondary school institutions, industrial entities as well as local government cooperate more and more, while 46% examinees agreed, and a very small number of them 4% or examinees) did not agree. 8% did not agree, and 6% were neutral.

Second hypothesis relates to the assumption that dual education brings qualitative personnel who care about the development of business skills constantly attending advanced training and advancement; the examinees assessed this assumption very positively. They consider that dual educational system can improve communications skills of pupils and students and increase their social skills (54% agreed completely while 21% agreed). Some of them (7%) emphasized their negative attitude, partly negative attitude (10%), and neutral (8%). A greater number of examinees cite that dual educational system enables pupils to make progress and to take advance training. 37% agreed while 38% of examinees agreed completely. 8% of examinees had no positive attitude, partly negative attitude also 8%, while neutral 9% out of the total number of examinees.

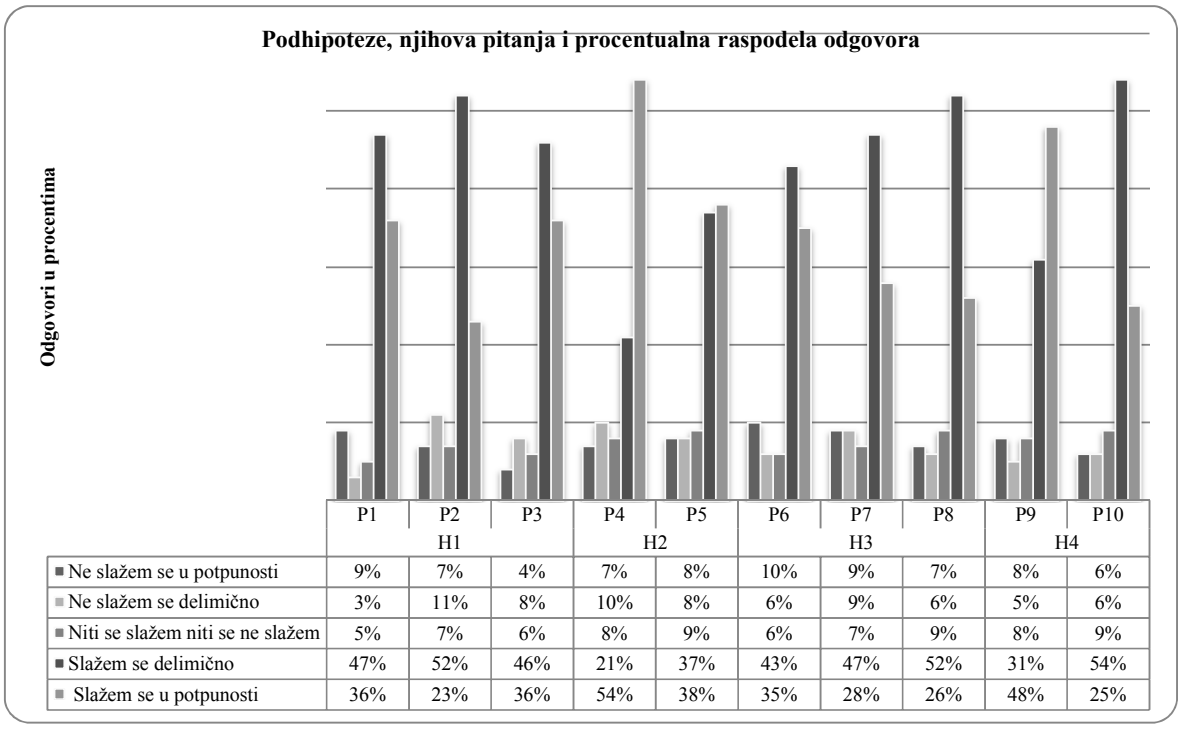
Third hypothesis relates to the importance of introducing dual educational system on the territory of the City of Zrenjanin as well as to the fact that introduction of dual educational system on the territory of the City of Zrenjanin reaches general progress and development of the surrounding area. Stimulus and motivation are provided to young people to stay and develop the city where they live. The examinees points out their positive attitude toward introduction of dual educational system on this territory. They consider that with the introduction dual educational system on the territory of the City of Zrenjanin general progress and development of the environment is attained. This statement is confirmed by 31% examinees while 48% completely agreed, 8% had negative attitude, 5% had partial attitude, and 8% were neutral. The examinees consider that the dual educational system on the territory of the City of Zrenjanin has been becoming represented more and more. 54% of examines agreed, 25% agreed completely, 6% had negative attitude, and 9% were neutral.

All sub-hypotheses prove the main hypothesis of research according to the percentage of positive answers.

TABLE 1 SUB-HYPOTHESIS, QUESTIONS AND PERCENTAGE DISTRIBUTION

Sub-hypothesis	Question	Question	Do not agree	Do not agree	Neither agree nor agree	Agree partly	Agree
H1	Q1	Unemployment is reduced by introducing dual educational system	9%	3%	5%	47%	36%
	Q2	Positive effect on government system is achieved by introducing dual educational system	7%	11%	7%	52%	23%
	Q3	Greater collaboration is achieved between school institutions, industrial entities, and local self-government	4%	8%	6%	46%	36%
H2	Q4	Dual educational system may improve communication skills of pupils and students, advance their social skills	7%	10%	8%	21%	54%
	Q5	Dual educational systems enables progress and advanced training to pupils	8%	8%	9%	37%	38%
H3	Q6	Noticeable results in industry are reached by introducing this system	10%	6%	6%	43%	35%
	Q7	Dual educational system enables students conducted by mission, vision, and ambitions to realize conceived goals reaching notable results .	9%	9%	7%	47%	28%

	Q8	Introducing this system increased diversities and dissimilarities in school institutions are reached	7%	6%	9%	52%	26%
H4	Q9	Introducing dual educational system on the territory of the City of Zrenjanin general progress and development of the surrounding is realized	8%	5%	8%	31%	48%
	Q10	The system of dual education on the territory of the City of Zrenjanin is more and more Represented	6%	6%	9%	54%	25%



	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
	H1			H2		H3			H4	
Ne slažem se u potpunosti	9%	7%	4%	7%	8%	10%	9%	7%	8%	6%
Ne slažem se delimično	3%	11%	8%	10%	8%	6%	9%	6%	5%	6%
Niti se slažem niti se ne slažem	5%	7%	6%	8%	9%	6%	7%	9%	8%	9%
Slažem se delimično	47%	52%	46%	21%	37%	43%	47%	52%	31%	54%
Slažem se u potpunosti	36%	23%	36%	54%	38%	35%	28%	26%	48%	25%

Figure 2. Sub-hypotheses, their questions and answers distribution in percentage

VII. DUAL EDUCATIONAL SYSTEM AT UNIVESTIY INSTITUTIONS

The Technical faculty "Mihajlo Pupin" has its goal to increase and advance education quality. Many partnerships have been founded with industrial entities collaborating with the Regional Economic Chamber and Employers' Union of Zrenjanin. Student's training in companies is considered to be of great importance. In the school year 2014/2016^{th,} the first students enrolled the new accredited study program "Industrial Engineering in Oil and Gas Exploitation" at the Technical Faculty "Mihajlo Pupin" Zrenjanin. This interdisciplinary study program was initiated by the NIS in order to set bases for qualitative and complete education of engineers, thus the NIS would provide master personnel potential in Serbia for the long-term development of the company. The program has been realized in cooperation with the Uhta State Technical University (UDTU) from the Russian Federation (Republic of Koma). The faculty in Zrenjanin educates qualitative IT personnel that can be concluded from the signed agreement about business-technical collaboration between Netherland's Levi9 IT Services and our faculty. The aim of the collaboration is to provide adequate knowledge and training in IT field for the information technology major students of our faculty as well as to give them chance to get employment at the prestige IT Company in Serbia after they will have graduated. Collaboration of the faculty with the Business Circle in Zrenjanin is also very important for the circle directs constantly towards the young and perspective personnel. It has been aimed its collaboration towards the students of the Technical faculty "Mihajlo Pupin" Zrenjanin for years. Their basic goal is progress and development of the surrounding, and to motivate and encourage young people on the territory of the City of Zrenjanin. The Advanced Technical School of vocational studies also encourages dual education through various types of training their students working together with the industry and organizing different projects. "Preduzetnicki Baby Boom in Banat" collaborating with the International Business School Styria, Graz, Austria and the Regional Centre for Social-economic development "Banat", d.o.o. have a strategic goal to contribute to creating Banat as a region with the highest rate of young entrepreneur in Serbia till the year 2020. Likewise, one of the significant projects of this school is the project co-financed by the

ERASMUS PLUS program of the European Union. The year behind us has brought a very successful cooperation with the Advanced Technical School of Vocational Studies in Zrenjanin and Technical Faculty "Mihaljo Pupin". These two higher educational institutes have a common goal to increase the educational level obtained at these institutions. First of all to cherish knowledge, skills, and abilities in order to reach imposing results in sciences. One of a very important result of the Technical Faculty "Mihajlo Pupin" is a worldwide-acknowledged conference ACE 2017 that is held at this faculty. It is multidisciplinary conference attracted by people of various interests and discipline.

The Zrenjanin Business Circle represents a socially responsible organization that operates on the territory of Middle Banat. An organization operates in its surrounding very positively and an organization those strengths its reputation in the region too. The association was founded on 1 December 1990 in accordance with the Law about Associations of the Republic of Serbia and with assignment to father the most respected and the most successful business people who had chosen for their living, centre for their business activities the region which administrative, cultural, sport and industrial center is the City of Zrenjanin. Their basic goal is general progress and development of the surrounding, as well as to motivate and encourage young people on the territory of the City of Zrenjanin. They advocate for social responsibility as well as for sustainable development of their business based on these strategic questions. Wishing to accomplish mutual goals as well as creating vision the Zrenjanin Business Circle has signed partnerships with successful and respected companies, such as Employers' Union of Serbia and Employers'' Union of Vojvodina. Entrepreneurs are often considered possessing abilities to see chances in the surrounding and to make benefits from it in a proper manner, on time, and in the right place. The strategy of business is based on certain target groups and area. It is necessary to invest constantly in new resources in order to achieve certain success on the market. [5]. Very often, it is necessary to take the risk in order to realize general success of the company as a whole. It is necessary to develop and place successful ideas in order the corporation where we work would realize its profitability and flexibility in its business. Today more and more companies introduce teamwork with the aim to increase its efficiency.

Possibilities for developing IT sector in Zrenjanin are given in an interesting research supported by the Zrenjanin Business Circle and Zrenjanin IKT Cluster [6].

VIII. Dual Educational System In Secondary Schools

Chemical, Food and Textile School "Uros Predic" in Zrenjanin educate pupils and adults as a Center for continuous adults' education. This school offers a very wide range of courses that can be very interested for certain target groups. It also performs formal and informal education. It is necessary to underline that the school performs consulting directly with industry that is of a great importance for today schooling. Diversity in work is present through numerous educational profiles that enable direct work in industry. After completing studies, it enables pupils to work on production lines from raw material preparation until final processing of the products, organizing and leading the whole food chemical production line. The school gives many positive examples collaborating with other institutions and industry. Some examples are: taking part in the "Night of Researchers" with the workshop "Ice Crystals with Taste and Smell", "Mill-bakery Days" held in Novi Sad, competition of the Company "Lesaffre Serbia", and taking part in the international conference of food profile students. The cooperation with the Technical School of Vocation Studies "Preduzetnicki Baby Boom in Banat" is very important. The basic aim was to improve entrepreneurial knowledge; motivation and competency ability of vocationally oriented secondary school students in the Banat region through getting know the standardized model of entrepreneurial education. Realizing its curriculum and syllabus the Secondary Agricultural School collaborates with agricultural economy, flower and vegetable producers, veterinary stations, institutes, faculties, light industry, carpentry and furniture producers, Association of agricultural and forestry schools, and many others the Technical School in Zrenjanin represents the dual educational system. Within the above noted activities, a cabinet for teaching oil and gas production and drilling techniques was opened. This project was realized with the help of the company NIS and Technical School with the aim to improve and modernize the conditions to perform teaching for the students of the second and third grade on the major manager of facilities in oil and gas production. There are various educational profiles at the school. After completing their studies at this school, the students are trained to work in constructing and projecting offices using computers with the most modern CAD software, processing with computer simulations together with video presentation teaching, work in companies that supply passenger

transfer services in city, intercity or international traffic. Another advantage that this school possesses and refers to improved education system is that motor vehicle drivers' training is performed on the vehicle owned by the centre for drivers' training at the Technical School, passenger, and freight vehicles. Connecting industry and educational institutes is realized by most school on the territory of the City of Zrenjanin in cooperation with many economic entities. The ***Economic School*** develops a sector of catering, develops cooperation with tourists organizations, and a great number of restaurants. Collaboration with the company "Gomex" is also very important and very successful cooperation on the field of economy. Other schools in the city also represent positive examples. The ***Medical School*** points out its successful cooperation with the Community Health Centre, General Hospital, as well as private health institutions on the territory of this city. During the Conference "Dual Education in the Function of Labour Market" in the Economic Chamber of Serbia, competitiveness is achieved thanks to dual education. Education in dual system brings smaller unemployment, increased efficiency, and productivity on the business market.

IX. CONCLUSION

In future, the success of a company will depend on the ability of organization to use collective wisdom that is a set of accumulated thoughts, perceptions, experiences, intuitions, and intelligence. The wish of any company is to innovate its business and to place on to new markets that can be local or in some cases global. There is possibility to advance in certain position in the organization. In this was the state gets qualitative, young, and perspective personnel. Examinees emphasize that if we lead the strategy of personnel education that are really needed to companies, we shall reach impressive results in many industrial fields. It is necessary to take care of such an education system in order to decrease general unemployment in our country. The dual education system can improve communication skills of pupils and students increase their social skills constantly improving their oral skills, enriching business vocabulary phrases necessary in the business world, leading by mission, vision, and ambition to reach thoughtful goals and notable results.

The main hypothesis is "There is a positive attitude towards dual education and its representation of application on the territory of Middle Banat" and it is proved by its sub-hypotheses that has been illustrated and discussed in this paper.

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Interaction on Google Classroom and Group Communication: a Case Study of an ESP Group in CST at South East European University

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Abstract - In the digital age, group communication is transferred online. Google Classroom serves as communication center for students who study together to solve particular problems. This research uses qualitative content analysis and interviews to determine whether discussion forums on Google Classroom could be viewed as group communication in the usual scholarly explanation of the term. The findings suggest that online discussion forums have all five features of face-to-face group work – size, interdependence, assignment, individuality, and norms. The study concludes that though online forums introduce limitations to interactions, discussion forums can indeed be viewed as group communication.

I. INTRODUCTION

Group communication means interaction of three or more individuals to accomplish a certain task (e.g., Rothwell, 2013), and it is generally supposed that people can achieve more by working in groups with others than they can by working on their own. In the digital age, group interactions has started to migrate online. Groups collaborate through email, discussion forums, and are generally using Internet tools such as Google Classroom that allow working on their group projects remotely. Online support groups are appreciated by individuals in need of compassion (Turner, Grube, and Meyers, 2001). Participation, context, timing, and structure of interaction in Google classroom are automatically recorded, providing rich group interaction data for researchers. Although online group communication appears beneficial to all those participating, scholars noted several deficiencies of web interactions for teams, such as poor relational development (e.g., Galston, 2000; Straus, 1999) and excessive group size (Jones, Ravid, and Rafaeli, 2004) that could lead to poor group cohesion (Rice, 1987). Thus, it is important to understand how modern online communities function and whether interaction between people in such format can qualify as group communication in its traditional understanding and fully substitute face to-face group interactions. This study focuses on Google Classroom group communication, a prominent example of an online user forum at South east European University. It is a technical support community that is hosted by the Google, but with content generated solely by its users. The study analyzed what features of group communication these discussion threads had and whether they could be seen as similar to face-to face group work.

II. LITERATURE REVIEW

While face-to-face group communication is commonly defined as three or more people working interdependently for the purpose of accomplishing a task (e.g., Myers and Anderson, 2008, Rothwell, 2013), online communities are often larger networks of people who gather around a common purpose or activity and use computer-mediated communication as their primary means of interaction (Baym, 2000; Rheingold, 2000; Smith and Kollock, 1999). In order to explore how online interaction fits into the description of group communication, I analyzed how features of computer-mediated communication identified by scholars align with the core concepts of traditional face-to-face group communication. The literature review focuses on the five commonly accepted features of groups – size, interdependence, task, identity, and norms (Keyton and Beck, 2009).

A. Group size

Online groups can be very large in size compared to traditional face-to-face groups (Black et al., 2011; Huffaker, 2011; Rice, 1987). Jones, Ravid, and Rafaeli (2004) found that the larger the online group was, the fewer messages were exchanged between members and the shorter they were. Huffaker (2011), on the contrary, argued that group size positively impacted communication activity and shared language, but agreed to previous findings which showed that the more discussion participants there were in online groups, the more likely information overload and lack of group cohesion might occur (Rice, 1987). The size of online groups affected group stability, contributing to both acquisition of new members

and loss of older ones (Butler, 2001). Such membership turnover could have a negative impact on group performance and member loyalty (Van Vugt, Jepson, Hart, and De Cremer, 2004) and impede communication activities (Butler, 2001). Thus, the large number of individuals involved in computer-mediated interaction at the same time and on the same topic is commonly viewed as a factor impeding group communication experience. Despite the large size of online groups, few participants are active contributors to community interaction (Howison, Inoue, and Crowston, 2006). Communication tends to occur in smaller groups of users (Black et al., 2011; Haffaker, 2011). These users, perceived as leaders of online groups, contribute more valuable information than others and engage social as well as technical communication to keep community interactions going (Butler, Joyce, and Pike, 2008). Depending on online community size, then, member participation in online discussions and their input and engagement can be unequal (Huffaker, 2011).

B. Task

Group members are interdependent and coordinate their efforts to accomplish a common task, which is the purpose of the group's existence (Myers and Anderson, 2008). Weisband and Atwater (1999) found a significant correlation in on line communication groups between the frequency of a member's task-related messages and the degree to which this member was liked by other members. In face-to-face groups no such relationship was found, and Weisband and Atwater concluded that liking in face-to-face communication was based on non-rational or non-task bases of attraction, whereas in on line comminication partners liked those who contributed to their groups' tasks. The balance of task and relational communication can be difficult to achieve for virtual teams and online groups (Black et al., 2011), and scholars agree that computer-mediated interactions are usually skewed towards task-related communication (Rice and Love, 1987; Walther, 1992). However, some online communities (e.g., discussion forums) are more recreational and offer place for users to discuss topics of shared interest, exchange images and videos, or tell stories, which makes these communities not as clearly task-oriented (Black et al., 2011). It appears that task-orientedness of interaction in online communities depends on the specific context of each discussion. Li (2007) found that face-to-face groups performed better than computer-mediated groups in problem analysis and criteria establishment. On line communication groups were also significantly less efficient than face-to-face groups in terms of communication effectiveness. While they used double the time to complete their tasks, they only produced half of the communication messages that their face-to-face peers produced. At the same time, although face-to-face groups performed communication functions better, they did not necessarily have better group outcomes than on line groups groups. Furthermore, Walther (1992) argued that computer-mediated communication was more efficient in performing tasks than traditional group work due to its lack of unnecessary emphatic and emotional cues. Whether online groups are an efficient means for solving tasks depends, then, on the type of the specific task and characteristics of the group.

C. Group norms

Characterized by Myers and Anderson (2008) as one of the secondary group features, a group norm is perceived as a rule that groups adopt to regulate members' behavior (Bonney, 1974; Feldman, 1984). Active group members establish and legitimize certain group patterns that may eventually become norms (Bettenhausen and Murnighan, 1985). A task norm enables the group to work towards task accomplishment, a procedural norm outlines the procedures the group will follow, and a social norm defines how group members engage in interpersonal communication (Myers and Anderson, 2008). Norm violation can cause sanctions to be imposed on group members (Shaw, 1981). Different online communities appear to feature a variety of norms specific to their specialization and format. However, comparatively few pieces of computer mediated communication literature touched upon the topic of group norms. This may be due to the multiplicity of online community types and the emergence of new ones over the past few years. Early CMC studies made a general assumption that norms in computer-mediated communication developed over time and helped to mediate online relationships between group members (Walther and Burgoon, 1992). Similarly, Black, Wesler, Cosley, and DeGroot (2011) argued that the establishment of group norms should govern online group members' behavior. Such governance processes are important as they help to coordinate communication of members who may be geographically dispersed or have different expectations about group work. Procedural and social norms in online communities can be imposed not only by website administration, but also directly by group members. This study explored whether norms of an online forum were closely followed by members and whether members in select threads came up with norms of their own.

III. METHOD

To collect data that would help to answer the research question, a qualitative content analysis of information-rich discussion threads from different sections of the Google classroom was conducted. Based on the assumption that interaction between users within one thread might be seen as group communication, a forum thread composed of posts made by individual forum users served as the unit of analysis. I studied multiple discussion threads and employed purposeful criterion-based sampling to select 10 information-rich cases based on three criteria. First, the thread had to be marked as "resolved" by users. Second, I looked for threads where three or more users were engaged in a discussion. Finally, I selected threads that had a sufficient number of posts and information in them to be considered a discussion rather than a question and an immediate answer to it. The time frame for the study was from February 22nd, 2017 to April 25, 2017. This time period is explained by the fact that while most of the analyzed threads were active for a comparatively short period of time (e.g., a week), two of the analyzed discussion threads remained active for almost a year, and information in both of them was relevant for the study. In order to determine the size of the possible online group, I counted the number of active users in the thread. I considered a user to be actively involved in the discussion if there were three or more posts from him or her. I classified some of the analyzed discussion topics as mainstream, as people in them were discussing everyday electronics users' concerns, such as poor battery life or slow software performance. Other threads discussed more specialized and technical issues. I used comparison to classify users' communication in the threads as relational or task. Thus, I analyzed textual data from discussion threads that related to the studied online group communication features (member interdependence, group identity, task, and norms) and then compared the findings to those in the existing literature. I also conducted online interviews of several individuals who were Communities' forum users in order to get an inside perspective at the discussions. I asked questions regarding relational and task communication in forum threads, as well as regarding perceptions of group work in general. Combining interviews with textual data analysis allowed for some data triangulation and positively affected the validity of study results.

IV. RESULTS

The member base of Google Classroom amounts to hundreds of users, all of which share the identity of being owners of Google classroom profile. Every Google classroom user can become a member by registering on Google classroom with their ID. Community interactions are conducted through textual messages and take the form of threads. Users create multiple new threads every day inquiring about issues they have with their on site classes The forums include a reputation system that allows users to thank helpful members by "liking" their posts, marking posts as useful, or indicating that a specific post helped to resolve the issue discussed in the thread. Thus, users earn points by posting helpful responses – five points for useful responses and 10 for the one that helped to resolve the issue. The more points a user has, the higher their rank (from first to sixth) and the more privileges they have. Users can also indicate that they have the same issue as the topic starter by clicking the "I have this question too" button. However, as the observations showed, this feature was not used by many users. On the contrary, most users appeared to ask questions that had already been asked before. This is a violation of the Communities' ethics norm, as users are expected to first try to search for an answer and only after that ask a new question. This partly explains why interaction in the majority of threads comes down to one or two answers from other community members, which is enough to solve the issue. Such threads cannot qualify as group interaction as only two users are involved, and they do not communicate information sufficient for analysis. Other interactions, however, spanned over several months and occurred between many users, which generated some rich data on member interdependence, identity, and specific norms within each of the online community interactions.

V. DISCUSSION AND CONCLUSION

The purpose of this study was to determine if a discussion thread on a web forum could be viewed as group communication. Results of textual analysis of Google Classroom threads showed that five features of group work were to varying degrees present in users' interactions. The number of active participants ranged from three to ten people. Users depended on each other for information, and their communication demonstrated relational development. For the most part, user communication was task-oriented and aimed at finding solutions to issues. Although there were exceptions, users in general tended to follow ethical and organizational norms of the forum. Finally, members identified with each other on issues that mattered to them. At the same time, some of these features took forms that were different from those found in traditional face-to-face groups. Observations showed that not all

users who communicated in a thread shared the same identity, and sometimes users could split into two opposing camps within the same discussion, each with its own shared beliefs. Furthermore, some users' posts did not show evidence of them identifying with anyone else. A discussion thread, then, cannot be viewed as group interaction in itself, as some discussion participants did not identify with others. Absence of a clear group task and an end result to user interaction in select discussions was another issue that made it difficult to view such forum threads as group work. Despite the fact that topic starters marked these threads as resolved, the discussion, comprised primarily of user complaints, kept going on. Posts lacked task-related communication, and such threads appeared to be aggregates of user feedback rather than purposeful group discussions. At the same time, however, several discussion threads were rich on task-related communication and did have a clear outcome. Thus, an online forum interaction may or may not have an end result. It appears that threads dwelling on mainstream issues are less likely to have an end result, while threads that address specific technical questions are more likely to arrive at a definite conclusion. Further research is needed to confirm this hypothesis. Google classroom user norms and the organizational specifics of user interactions on the forum can be seen as an impediment to relational development and traditional group communication. Specifically, it was up to just one user (the topic starter) to mark posts of others that either helped to solve the issue or completely resolved it. Other participants' privileges were limited. Although they could "like" posts, it was not as clearly visible as "This is helpful" or "This resolved my issue" markings. These limitations, however, did not seem to significantly influence users' interactions. Most importantly, only two of the analyzed discussion threads possessed five core features of group communication at the same time. While all 10 interactions had an appropriate number of users involved, and at least one of these users was dependent on others for help, one or more of the three other important group features was missing. Users either did not show evidence of shared identity, failed to follow norms, or did not have a clear group task that they worked to accomplish. With these features absent, these threads cannot be viewed as group communication. While acknowledging the specifics and limitations that web forums introduce to the communication process (e.g., interactions can only be sequential), I argue that member interactions within these two discussion threads can be viewed as group communication. This study had certain limitations. Due to resource constraints, a comparatively small number of discussion threads was selected by purposeful non-probability sampling methods and then analyzed. While qualitative content analysis helped to collect rich data, the findings cannot be generalized and applied to other threads or discussion forum websites. Quantitative research methods and random sampling would allow for a systematic analysis of a larger number of discussion threads and expand the applicability of findings. Another limitation was the lack of interviewee participants. The number of the interviewees should be increased to provide for better research validity. For future studies, a coding scheme can be created to determine whether specific patterns or words in textual interaction of members on web forums point to member interdependency, group task, norms, or identity. Then, using quantitative research methods, it would be possible to test the assumption of whether the discussion topic influences the presence or absence of an end result in group interaction.

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The Method for the Formation of Groups of Students in a Collaborative Learning

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Abstract - The paper presents a method for group formation in a collaborative learning. The goal is to form a finite number of n-people groups given a total number of students. This was done by the application of the Conflict Analysis theory introduced by Z. Pawlak. Proposed method requires the definition of possible actions in a collaborative learning process, as well as student's requirements given the actions. As a result of the investigation an estimator based on polynomial curve fitting was generated according to experimental data set. This gives an opportunity to estimate the total number of possible n-people groups given the total number of students, but taking into account student's requirements.

I. INTRODUCTION

Given that there are multiple constraints in today's learning practice for students, as well as for teachers, many forms of collaboration are often used in order to perform well on a given tasks. These tasks differ for students and teachers: the differences concern roles of students and teachers in a learning process. Researches in the field of collaborative learning have indicated that it is important to create an interesting learning environment for students, as well as for teachers. This paper mostly deals with students' collaboration, e.g. collaboration between students in a collaboration group or even between different collaboration groups. The student's satisfaction in terms of motivation, knowledge building, time consumption, etc is indeed very important in the learning process. By raising the level of satisfaction and fulfillment of students regarding learning process and acquired knowledge versus time consumption rate, it is possible to improve whole experience which has again positive impact on knowledge acquiring rate and the learning process.

The collaboration in a learning process has been tackled by many authors. Some of them performed deeper analysis and have reached to certain conclusions. Many research and studies were undertaken in order to acquire some knowledge and guidance on how to collaborate. As it is well known, learning process is often performed by on-line learning environments and this is common practice, given current state of IT infrastructure.

In [1] the interaction and participation of students in on-line environment has been investigated. The knowledge building process was executed over some forums and the planning process was executed over Moodle learning management system (LMS). Authors of this study found that after 14 weeks of the process there was a significant relation between the use of opinion building and expressing forms and the creation and build-on of notes by the students. Results also show that the on-line collaborative environment contributed to opinion building and expression, the quantity, content and quality of interaction and participation, and thus the learning of students.

In [2] an approach to collaborative learning based on game-like learning environment is described. This approach used a grid-based game Mindtool to facilitate the students to share and organize what they have learned during the gameplaying process. Based on the experimental results, it is found that the Mindtool-integrated collaborative educational game benefits the students in promoting their learning attitudes, learning motivation and improves their learning achievement and self-efficacy. The proposed game-based learning approach has shown significant effectiveness in improving the students' learning performance.

Self-regulated problem solving through computer-based instructional methods was investigated in [3]. A synchronous computer supported collaborative learning tool named "Synergo" was used, as well as the Moodle LMS; the process is phase-based. In the beginning there is an observation phase which involves the visual demonstration of the model for advanced thinking skills and the way it should be applied into a problem-solving activity in math. But the collaboration phase plays a vital role as a tool in student's active thinking process. This method suggests two sub-phases of collaboration: firstly,

students work in a team of four and after this students form teams of two members alternating the role of solver and listener-peer reviewer.

In [4] the GeoGebra package is introduced to the small four member group in a calculus course. This package enables the students to check whether each step in the process of solving a task was correctly done or not. This environment shows that working in collaborative groups yields better results than working alone.

There are some definitions of collaborative learning: in [5, 6], a very wide definition is adopted from [7] meaning that collaborative learning is as a "situation in which two or more people learn or attempt to learn something together.". In this definition, "two or more people" can be interpreted as a pair, a small group, a class of 20–30 students, a few hundred or thousand people, several thousand or millions of people. In [8] some limiting factors and issues of importance when collaborating are given and these are: fear of plagiarism, student reticence, effort, assessment and technical support. This means that in a collaborative learning process all involved subject must be aware of these possible pitfalls.

It is obvious that collaborative learning is adopted as a learning strategy in an on-line or off-line manner, while groups were formed measuring student's properties. There are many group formation strategies based on opinion building methods, solver versus listener role cooperation, learning attitudes, learning habits, previous knowledge base, etc.

These collaboration groups are often formed by ad-hoc principle: collaboration partners are friends or they are just sitting to each other in a class. The question is: Is there a way to form these groups in a more formal manner, such that collaboration group is as compact and efficient as possible? For a student, the question is: Who is the best partner for collaboration in order to master the learning material easy and in shortest time?

In this work, a question of collaborative group formation via student's request is tackled. Having in mind that requests are taken into account purely from the perspective of creating an "optimally operative" learning environment it is a must to have a method for collaborative learning group creation based on student's requests.

The rest of this paper is organized as follows: second section presents a method used for collaborative learning group formation; some definitions are given and explained. Third section gives a case study of a method application regarding the estimation of total group count vs. total student count, while last section gives some conclusions and future work guidelines.

II. METHODS

The collaborative learning group formation is done by applying a theory originally conceived by Z. Pawlak in 1998 [9] and further developed by Deja and Slezak [10]. Although this theory was investigated and enhanced in some ways, most basic concepts are used to define a group formation method. Originally, the theory deals with conflicts and alliance formation method, but it can be applied to the domain of education in order to use an alliance as a collaborative learning group representative. Some basic definitions are given in following lines.

Information system is a basic building block of this theory and is defined as a pair $S = (U, A)$, where U is a non-empty set of objects (agents), while A is a finite set of attributes (issues). Previous definition of the information system can be found in [9], as well as in [10]. In this case V_a is the set of values of attribute a and V_a={-1,0,1}. As for domain of education, agents are usually students or teachers, while there is more variety in issues determination. In this work agents are students while issues are treated as actions. Three possible values refer as against some action (-1), neutral towards an action (0) or in favor (1) of some action. Function (1) is defined in following manner:

$$\phi_a(x,y) = \begin{cases} 1 & if\ a(x)a(y) = 1\ or\ x = y \\ 0 & if\ a(x)a(y) = 0\ and\ x \neq y \\ -1 & if\ a(x)a(y) = -1 \end{cases} \quad \ldots (1)$$

For two students x and y if the value of the function equals 1, then both students have same opinion regarding some action, if the value of the function is 0, then at least one student is neutral about the action, but if the value of the function is -1, then both students have different opinion on this action.

Now, it is possible to define three basic relations: alliance, neutrality and conflict, as in (2):

$$R_a^+(x,y) \;\; iff \;\; \phi_a(x,y) = 1$$
$$R_a^0(x,y) \;\; iff \;\; \phi_a(x,y) = 0 \quad \ldots (2)$$
$$R_a^-(x,y) \;\; iff \;\; \phi_a(x,y) = -1$$

In order to calculate alliances there is a distance function defined by (3):

$$\rho_B^*(x,y) = \frac{\sum_{a \in B} \phi_a^*(x,y)}{|B|} \quad \ldots (3)$$

In (3) B is a set of actions and following function is included:

$$\phi_a^*(x,y) = \frac{1 - \phi_a(x,y)}{2}$$

By applying (3) for every pair of students it is possible to calculate the value of their mutual distance. A pair (x, y) is allied if $\rho^*(x, y)<0.5$, neutral if $\rho^*(x, y)=0.5$, and in conflict if $\rho^*(x, y)>0.5$. If a pair of students is allied then they are collaborators.

III. A CASE STUDY

Presented method was tested on a simple data set. In Table 1 an example based on [9,10] is given. There are six students and five actions (a, b, c, d, e); each student requires some action (+), student is against some action (-) or does not really care (0).

TABLE I. STUDENTS AND ACTIONS

Student/ Action	a	b	c	d	e
1	-	+	+	+	+
2	+	0	-	-	-
3	+	-	-	-	0
4	0	-	-	0	-
5	+	-	-	-	-
6	0	+	-	0	+

By applying (3) the conflict Matrix from Table 2 was formed and following collaboration groups emerged: CL_1={1, 6}, CL_2={ 2,3,4,5}, CL_3={5,6}. This means that students 1 and 6 are collaborators, but also student 6 can collaborate with student 5, but student 5 can also collaborate with students 2, 3 and 4. Furthermore, this means that student 6 is in position to make a choice to collaborate with student 1 or to collaborate with student 5. Student 5 is also in the position to make a choice to collaborate with students 2, 3 and 4 or with student 6. Although multiple collaboration groups are possible, sets CL_1 and CL_2 are sufficient because these two groups form the partition of the universe, while CL_3 is superfluous.

TABLE II. CONFLICT MATRIX

	1	2	3	4	5	6
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.9	0.0	0.0	0.0	0.0	0.0
3	0.9	0.2	0.0	0.0	0.0	0.0
4	0.8	0.3	0.3	0.0	0.0	0.0
5	0.8	0.2	0.2	0.4	0.0	0.0
6	0.4	0.5	0.5	0.6	0.4	0.0

As the data set presented in Table I is a very small and simple, it yields very simple conflict matrix given in Table II. Further, a case study was conducted on bigger data sets in order to investigate a number of collaboration groups in relation to the size of the data set. For that purpose a Java program was written in order to calculate the number of possible groups of maximum 5 students without taking into care data partitioning. The case study was conducted on a small data set originating from real-life situation which occurred at Machine Learning course at Technical faculty "Mihajlo Pupin" in Zrenjanin, Serbia, but this data set was extended with new examples. Actions are: a) basic gradient descent algorithm explanations, b) further learning rate explanation, c) one-layer neural network showcase study, d) backpropagation algorithm theory, e) the usage of multilayer neural nets. Every student is represented by a vector (a, b, c, d, e), for example: (+, +, -, 0,-) meaning that student is positive about actions *a* and *b*, negative about actions *c* and *e*, while he/she does not care about action *d*. Original data set comprising of 6 examples was iteratively expanded with additional randomly generated data, so that it was possible to count a number of collaborative groups in relation to data set size. Used data set sizes were: 6, 16, 26, 36, 46, 56, and 76. These collaborative groups are overlapping, so data partition is not calculated which means that real number of collaborative groups would be much smaller. Extreme cases such as: "bring it all" (+,+,+,+,+), "no to all" (-,-,-,-,-) and "I don't care" (0,0,0,0,0) are also included in data sample. In order to get an estimator of group count vs. student count the polynomial curve fitting approach was used, see Fig. 1.

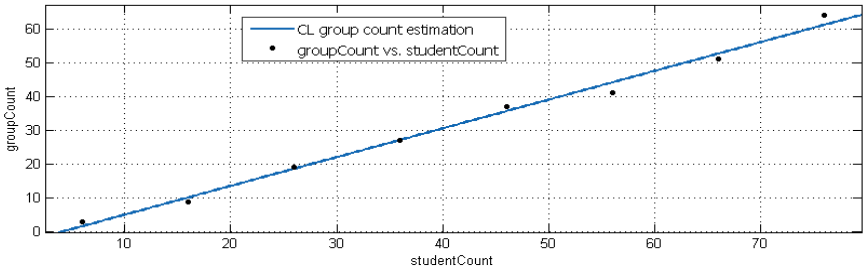

Figure 1. CL total group count estimation

This means that it is possible to estimate a total number of 5-people groups if we know how many students are included in a CL process.

IV. Results and Conclusions

The collaborative learning gains in significance as IT spread in educational sub-domains. Learning in a group is a long present, possibly IT independent, arbitrary efficient method. Today it is possible to organize on-line collaborative learning sessions, as well as "face-to-face" collaboration in real space and time. It is well known that a collaborative group structure has a great impact on learning process. There are methods to build a group based on opinions, solver versus listener role cooperation, learning attitudes, learning habits, previous knowledge base, etc.

In this paper a method for collaboration group formation based on required action is presented. This means that there are possible actions, as dictated by learning materials, and defined by a teacher or supervisor. Students included in collaborative learning process have their requirements toward these actions, but this does not mean that they are in position to impose their opinion, thus suppressing any learning strategy. Instead, this method is a part of a broader learning strategy, applied only when students naturally differ on their performances. This also means that student's requirements are collected via test, although this is not the only way, we can simply ask them about their opinion. Group formation through compatibility evaluation between students is done by conflict analysis – if students in a group are not in conflict, then they can collaborate, although this is not always true. This method is mostly on-line oriented, meaning that students are willing to collaborate with best possible peers, possibly not knowing who they are. Also, it is possible to create and recreate collaboration groups very fast and frequently. However, in this paper it is described how to form n-people collaboration groups given a total number of students. The estimator of total number of groups is created via polynomial curve fitting, based on sample experimental data. Linear model of the form $f(x) = p_1 x + p_2$ is formed where p_1 = 0.8488 and p_2 = -3.426 with 95% confidence bounds.

Future work will include group formation with data partitioning, which means that a smaller number of optimal groups will be generated. This approach will be tested on real-life sample, possibly through an on-line course via the internet.

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The Impact on Verbal and Nonverbal Communication, as one of the Most Important Factors of Quality Teaching Student – Teacher

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Abstract – This work is based on communication between professors (assistant) business communications with their students. The survey was conducted in the form of interviews with assistant tehničkee High School in Kragujevac. The aim of this study is to gain insight into the practical situation on the ground, ie. the actual situation as assistant business communication is communicating with his students. Communication is successful if the student and the professor (assistant) just understand message. Modern and successful professor (assistant) is the one that realizes high-quality and free communication with students. Professor (Assistant) who is trying to see everything, hear, recognize, notice, talk, advise, encourage, can be considered a modern and successful. Then he and his work successful communication with students at a high level, all of which creates a quality education between students and professors (assistants).

I. INTRODUCTION

The rapid development and continuous improvement of new technologies, new services and media enable faster flow of information. Unlike previous media (radio, television, newspapers ...) in which customers were only recipients of information and communication flowed single, new digital media provide broad population to be and their sender information and actively participate in two-way communication.

The need for the introduction and development of new technologies for communication and transmission of knowledge is recognized and becomes more and more present and in educational systems.

The best example may be the PowerPoint presentation, which is now almost indispensable tool of every teacher. When we take into account that in today's an accelerated pace of life in the face communication Loic (eng. Face to face) is almost equal to the online digital communication, the importance of encouraging such forms of communication in order to improve the quality of teaching and learning has become an unavoidable issue.

This paper will address the topic of verbal and non-verbal communication in the classroom.

The first part will define the communication process, as well as the type of communication. Then I will introduce and describe the most important and most frequently used verbal and nonverbal forms of communication in the classroom, on concrete examples to describe the possibilities of their use in the classroom and give advantages and disadvantages.

At the end of the paper survey was conducted in the form of interviews with the student business communications. In order to determine how the assistant interacts with your students, you used some of these verbal and nonverbal forms of communication ie. whether they are familiar with all the possibilities and whether you use such forms of communication.

II. COMMUNICATION

A. What is communication?

"Communication is the transfer of or exchange information, ideas or feelings. It is the process of sending and receiving verbal or nonverbal messages between people, through an agreed upon system of signs. "

Communication (lat.communication), in the broadest sense, is the exchange of information, the process of giving, receiving and transmitting information.

To communicate is not only to speak the words. To communicate means much more than that. This

means exchanging messages, thoughts, participate in the feelings of others. As more people know, the better they will communicate. The more and better communicate, have more opportunities for better and deeper exploring.

Mutual communication takes place between two or more people face to face with the possibility of immediate feedback. It includes verbal and nonverbal behavior, direct feedback, as well as internal and external policies. It takes place spontaneously, trained and planned. It is not static, but dynamic, requires mutual activity and influence each other. The quality of the establishment of relations significantly affect the performance of mutual communication. Mutual honesty and mutual trust that play an important role ...

On the performance of communication can also affect other factors that may arise during the communication process. Most often referred to the so-called noise and interference in the communication channel that interfere with the transmission of messages or user-friendliness on its way to the recipient. Common interference in communication speech can be insufficient volume, unreasonable speed, vagueness and ambiguity of the message, nuisance Environmental noise, disturbance of physical nature, such as stuttering, stopping and others. Or, if we go back to the beginning, communication is the process of conveying messages and other mental contents, using a system of signals and signs (speech, sound signals, symbols, labels ...)

III. TYPES OF COMMUNICATION

There are different forms of communication in the psychological pattern is usually described by three main dimensions of the content, format and order. Together, communication content and form create messages that are sent to the target. The goal may be man himself, another person or another entity such as a group, organization or society.

Taking into account these dimensions create the communication times, communication can be seen as:

- Verbal communication
- Non-verbal communication
- Intrapersonal communication
- Interpersoonalna communication
- Group communication
- Public communication
- Mass communication
- Active listening
- Telecommunication
- posredovanu komunikaciju
- computer transmission of communication

A. Verbal communication

Verbal communication is a form of communication in which for the first time think that it is about communication. We meet in the daily work, in leisure, in the media, other sources of knowledge and information.

So, if we want our listener to hear, not just listen, we need to be understood, but also closer to him mentally that would enable us to be easier to live in what we are talking. We have to be addressed and expressions that he knows and those close to him. If we have an important effect of our expertise and intellectuality it will of course express rich vokubularom, complex sentences and official expression.

In the case of students, we must be aware of the rules on the amount of information per hour that students can adopt and parcipirati. That we determined that sentences must be meaningful information to give a complete notice, but also sufficient time to process the student that fact or concept in a given period of time.

To that extent succeeded, we must be professors (assistants) that do not break the rules, expectations or norms of communication, showing interest in the student, respecting his ideas and thoughts are focused on the student, such as equal communication partners in a particular situation and a particular space.

B. Non-verbal communication

Non-verbal communication (which includes facial expressions, tone of voice, gestures, posture or movement, touch, sight) communication messages that are not expressed with words but by other means. When we say something to another person, the words themselves are less important than facial expressions and eyes, tone of voice.

The main reason for the non-verbal communication is as important as the human consciousness for a long time been the only means of communication. Knowledge of non-verbal signs can help us to better understand the people and reduce misunderstandings in communication. It also can help us to improve our non-verbal expression so that others understand better, and to avoid those characters that leave a bad impression

and make it difficult to communicate (runny noses or touching the nose, licking his lips, raising kaiprsta ...)

C. Interpersonal communication

Interpersonal communication is the most widely, but also an element of social communication. Its basic feature is the exchange of messages between two or more persons that due to the distance may be, face to face (small distance), yelling (increase distance) and through the media (telecommunications, internet communication). While inerpersonalno face to face communication is considered a basic element of education between professors (assistants) and a student, professor (assistant) with each other and among students (although we must note that such communication still is the most common in educational institutions, which is the foundation of learning, communication and cooperation).

The Internet communication through the media has become an everyday reality, not only in private but also in the educational world.

IV. COMMUNICATION IN TEACHING

When we say communication among students, the first association to this conversation. However nonverbal communication is and look, gestures, facial expression, strength and tone of voice, posture, movement, touch, smile ... unlike verbal communication, which is the basic function of transmitting abstract ideas, knowledge, information. Non-verbal communication convey emotional states and attitudes and regulate human relationships.

A. Communication in teaching through computers

Many studies conducted with the aim of comparing the work face to face and communications agency of computers. Thus establishing their differences in the quality of work and learning, realization of communication, satisfaction and motivation of students for work.

The research studied used the group mode, because it covers all aspects of interaction (teacher - content - students, professors, trainers student, student - student). This form of teaching emphasizes the active participation and cooperation of all institutions. Knowledge is actively creating in an educational institution (presenting ideas, their own conclusions, independent research and discussion) without relying on the professor's direct intervention of the teaching material.

Ocker & Yaverbaum (1999) describe a study in which they observed two groups of students who have together dealt the same subject group mode. One group of students met several times a day and guide discussion face to face, and the other the same theme processed through computers. The results showed that communication via computers, as well as face to face communication, with regard to the process of learning, quality of work and realization of communication, students have a disadvantage cited lack of group interaction and quality of group discussions.

Ellis (2001) describes a study in which they followed the work of students Network Computing (eng. Bachelor of Network Computing) at the Faculty of Information Technology in Australia with a view to determining the difference in learning with face to face communication and communication through computers. As part of the new themes (eng. Issues for human communications across the Internet) task of students was critically analyze and evaluate aspects related to the Internet as a popular communication media (intellectual property rights, equality, privacy on the network's identity). The main aim was to create a common educational environment in which students themselves to find, evaluate and analyze information and by mutual discussion make structured arguments and conclusions.

Performing topics was organized in two forms - a discussion face to face and a discussion on a special web-based forum. This met one once a day for two hours to lead the discussion and display the knowledge of their own regular statistical activities, and the professor to the entire process supervised. The rest of the time the students were left sasmostalnom research, information gathering and sharing content on the Internet forum set to increase the effectiveness of the learning process.

Results indicate fundamental differences face to face communication, communication via computer, as well as their advantages and disadvantages. Seven students (33%) indicated that the inability to obtain immediate answers to the question or comment as a lack of network communications. On the other hand, seven other students is considered communicate through computers is better, because it gives them a certain period of stagnation in which they can think, put together a quality message and response, thus relieved from the stress and fear of giving the wrong or wrong answers.

B. What is the subject of my interest?

His research has made itself in my High Technical School in Kragujevac. The school, which has about 1,000 students, has three directions informatics, road traffic, mechanical engineering Upon us with two modules: engines and vehicles and Urban Engineering.

At the present time before teachers are more and more asks requirements of active research and improvement of the teaching process, in order to independently obtain the results and conclusion. Professors (assistants) collect data on all important what happens during research - documentation, surveys, interviews, tests (Hubby, 1999). In this way, receive feedback and throughout the process of research can bring in the necessary changes and improve practices in line with the set objectives.

For the purpose of research should be started the question that comes from improving practices and proposes the following structure of the action plan:

- What is the subject of my interest?
- Why I started my own research?
- What might lead to change?

C. Why I started my own research?

Higher Technical College in Kragujevac is my first work experience. As assistant job I accepted responsibility and quite confidently, believing the competent person to execute the necessary obligations. Already the first few working days I felt insecure and a bit frustrated considering as it is almost impossible to connect university theory and actual practice.

The students of the second year of informatics were used to work in groups. This work was carried out in a way that actively perform most tasks. First-year students of informatics did not participate in the common work is not in the group. Communication among them - that was supposed to be the basis of group work - reduced to the minimum level of quality.

Frontal work I mainly managed through via the intended targets, but students are then particularly less communicated and were inactive. Different forms of work (individual or pair work) often refused. Individual work has shown that the communication skills of individual students poorly developed.

Insufficient and poor quality communication among students, passivity, indifference and even rude behavior resulting from poor successes.

Many problems and difficulties at school are due to the lack of adequate, efficient and high-quality communications. The causes of this absence are often underdeveloped students' ability to communicate. Such communication should be the basis of mutual respect, mutual respect, trust.

D. What could lead to changes?

Looking to achieve positive changes and the successful results, the first I relied on his own ideas, methods and strategies in the work, which were accompanied by advice colleague greater work experience. I changed my behavior and keeping a strict autotarivan access to students, customized by giving them a lot of tasks and activities that I thought was interesting and affordable for them. It is the main goal was to fulfill the tasks and goals of the curriculum. Unfortunately, such work did not achieve the desired results.

My colleague, who told me later in the study by helping, as a critical friend drew my attention to possible solutions and provide some advice. I realized as the school is not only an educational institution in a learning and accepting pre-agreed rules, but also an educational institution designed to meet the students' needs and wishes.

The quality of teaching depends on the quality and clarity of communication. According Bratanić (2002), communication means not only exchange messages and thoughts, but also participate in the feelings of others. To communication in school was good and successful, it is necessary to recognize their own and others feelings and able to adequately react to them.

Based on clearly defined problems, I developed a framework plan their action research:

• Objectives

At the start of the study, my first goal was to recognize the student's ability at their disposal in the field of communication. Method conversation I was focused on developing the capacity and skills of nonverbal communication, and improving verbal abilities in students earned by himself through practice writing and accompanying cover letter.

The goal was to create a pleasant environment in the school that will provide students the importance of their and others' emotions to communicate, as well as tolerance, which also contributes to quality and effective communication among students.

- **Criteria**

- Students longer cooperate and help each other in joint activities

- students understand concepts of "verbal" and "nonverbal" and when used to communicate both ways

- Students Students seeking to raise the awareness of emotions and express them verbally and nonverbally

- **Activities**

Teaching activities - workshops that I conducted:

1. **Envy - "No talking"**

   - "Seeking the soulmate"

OBJECTIVE: To develop the ability to communicate through verbal and non-verbal communication; to get to know students' activity "Wanted soul mate" for the purposes of quality and effective communication.

2. **Pisanje pisma – propratnog i motivacionog**

OBJECTIVE: To encourage non-verbal communication and participation in the presentation.

• Problems

Before I set goals and started researching, I encountered difficulties that were a reflection of inappropriate behavior of a few students. With them I have not met with the expected cooperation and respect, and I as a primer in the functioning of the educational felt fear and uncertainty in their business activities.

One of the students had difficulties with attention, concentration and motor skills is to continue to participate prilagađenom curriculum. For me it was a new experience, and it meant more preparation for classes. The student is therefore felt "different" from others is often refused any form of work and avoided their obligations.

When I thought about translating research and the introduction of positive changes in the teaching process, I lacked professional advice and support to other colleagues.

• Changes

Leading second-year computer science and in view of the perceived problems, I wanted to continue bring many changes and improve in line with the values such as good communication, better cooperation, mutual assistance, respect and confidence, both among students and between them and me. The introduction of the changes through this study it was not easy even for me as an assistant - beginners, but not for students who are following three school years need to adopt new and different way of working on academic studies.

V. THE CHANGES THAT HAVE OCCURRED IN STUDENTS

Students have become more open and freer to talk, tolerant, sensitive and attentive to one another. They have learned to talk about problems, express their own and recognize other people's emotions, active listening without falling into the affair. They have become more ambitious in the joint creation.

A student who had learning difficulties at the first workshop did not want to cooperate with other students in group activities and refused my help, later was more active and more collaborated with other students in joint activities.

• My changes

At the start of the study it was very important that the workshops take place in the way as I created them, I did not foresee possible deficiencies and changes during their translation. In fact, at the beginning 1.radionice one student refused to participate in the work, a few of them showed dissatisfaction with the formation of the group, which has disrupted the further course of the workshop. In these and similar situations unconsciously I showed mild tension, fear and dissatisfaction.

Over time I learned to listen to students' needs and adapt to them. in pursuit of mutual understanding encouraged himself talks about common problems, needs, interests and emotions. Thus we created mutual confidence and conditions for successful communication.

VI. CONCLUSION

It is indisputable that today's rapid development of information - communication technologies fast changing lifestyle of people, as well as the private spheres, as well as in all social activities.

The research showed that interviewed assistant business communication follows the trends as much arrives, takes into account the ideas of students who are surrounded by innovations and to continue implementing verbal and non-verbal communication through various workshops.

Based on literature studies and conducted research I concluded that the quality and effectiveness of communication depends on the interpersonal relationships of the participants in the communication. Communication should be based on mutual understanding, which implies recognition of each other's feelings and reactions to them.

With all the above, and the adoption of earning communication skills and the ability to require a lot of patience and time, more than the number needed for a research.

The satisfaction of students who have expressed interest and active participation in the workshop gave me a reason to be happy and alone. The research I have learned that is already very important to allow students the freedom to express their opinions, desires and feelings, do not restrain them, but they talked to the professor provide advancement opportunities in the private and social sense.

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Self-study with Langugage Learnig Software in the Workplace: What Happens?

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Abstract - The current paper provides literature overview on how different self-study packages can impact on students learning activity The paper presents review of literature on: previous researches, the current study of language products, and at the end the author of this paper will give his final conclusion which will provide answers that will raise awareness after the exploration of literature resources and implications for the future professional development.

I. INTRODUCTION

The use of computers and Internet have facilitate foreign language self-study components more and more accessible for handling, and now there is a wide range of software applications that represents language learning solutions, from which can be counted, free self-study programs, such as the BBC's online language offerings or LiveMocha®, and paid programs like Rosetta Stone®, Auralog®, and Transparent Language®. The main aim of this organizations is to promote their own self-study brands, from which the commercial brands are the most tempting for beginners, further explaining that they will aid "you to accomplish your language learning objectives quicker than you ever hope it's achievable" (Rosetta Stone), or that their program "is greatest progressive language teaching program accessible" (TELL ME MORE ®). Nonetheless to this day there has been no self-reliant experimental analysis that can support these allegations, and there is insufficient number of examples about learner experience or learning outcomes when individuals use computer facilitating language learning (CALL) products. After a brief analysis of current self-study, distance language learning, and language learning software, presented paper shows course produced to research on how self-reliant language learners are in use of language training programs. This research explore learner use of two famous products: Rosetta Stone and Auralog's TELL ME MORE.

II. PREVIOUS RESEARCH

So far there is no recorded analysis of foreign language self-study outcomes adopting commercially accessible stand-alone CALL components. On the other hand there is existing analysis from similar areas that propose that the most efficient learning is not accomplished by learners engaging individually, and that each components is constructed as stand-alone, self-study solutions will have to make up for this lack of social cooperation. For instance, researchers inspecting learner autonomy or "capability to take action of its own learning" (Holec, 1981, p. 3), make it clear that accomplishing autonomy-action which is questionable that is helpful to the language recovery action- which does not primary come as a conclusion of self-study.

As a matter of fact, Benson (2007) provides literature report on autonomous learning "learners do not evolve the capability to self-direct their own learning by being placed in position that has no other choice" (p.22). That means that autonomy is learner-constitutional and not circumstantial action. According to Fernandez Toro's training manual for foreign language self-study was explained that self-conducted learners need social backing.

In order to learning experience be rewarding, proper aid is desired for learners, not only in the form of learning contents (from which many are being formed by teachers), but also with appropriate guidance and exercise. Without the decent human resources no resource centre can run productively.

However, if learners are aimed to reach the goal in self-study they require more than just access to resources.

This allegation is backed in the research on self-access centers by the author of this paper in order

to raise awareness , and to show that they also represents resource centers (generally connected with a university or some other academy) that grant self-reliant language learners with self-study materials. The analysis of these centers ordinarily advise that self-directed programs need aid systems in order to be useful for language learning. For instance, Littlemore (2001) claims that this centers work finest when they offer thought-out support, instruction and practice. She consider that when universities are using self-access language centers in order to reduce costs, learner comfort was lower than when the centers were created to raise the language learning action with advising, rival work, and other instructed methods. Her analysis of the history of self-access language center at the University of Hull, Mozzon-McPherson (2007) supported Littleton's discoveries by describing the important degree to which language confidants commit to the autonomous language learning process.

Additionally this paper aims to raise awareness not just by authors research of learner autonomy, but also with analysis of networked, computer-mediated self-study, which include research conclusions from distance language guidance, which also demonstrate that cooperation is crucial to the accomplishment of online learners. Although distance learning research has broadly treated as instructor-mediated distance programs, some of the findings are related to computer-mediated self-study. For instance, a "sense of community" is crucial for any online learner (Liu, Magjuka, Bonk, & Lee, 2007; Sadera, Robertson, Song, & Midon, 2009; Rovai, 2002) but exclusively for foreign language learners which need an networked community to employ them in learning and also to cultivate themselves in gaining the knowledge of second language process (Compton, 2009; Fleming, Hiple, & Du, 2002; Hampel & Stickler, 2005; Lie, 2009; Murphy, 2008; White, 2006). Particularly, any program who was designed to simplify online language acquisition has to pursue the rules of efficient online course methods and also has to absorb the components of efficient instructed SLA, which also includes opportunities for production, cooperation, and convenient assessment, which need social communication (Blake, 2008, 2009; Lai, Zhao, & Li, 2008; Nielson & González-Lloret, 2010; White, 2006).

As commercially accessible packages like Rosetta Stone and Auralog vouch that they work as all-in-one explanations for language learning, program needs to be constructed to provide conditions useful to SLA. Nonetheless there is still insufficient experimental documentation about how to accomplish this. This absence of exploration on materials is not unique to CALL. As Chappelle (2010) specify "the number of presented work on materials assessment is unexpectedly low in aspect of the strike that materials have in the didactic process" (p. 67). Ulitsky (2000) gives perfect example of self-reliant learning that mention particular foreign language program of the learning plans of extremely motivated, sophisticated second language (L2) learners adopting one of two multimedia program packages designed for autonomous usage. The program packages were custom-built by advisers in the University of Albany, using Annenberg video series Destinos and French in Action, also using collective training and tests based on the contents of the videos'. The people who participated in this study were qualified learners who had either intermediate or beginning level in French or Spanish (learning the languages with which they have the least experience). Ulitsky debates about different methods that are chosen by these trained learners who worked through the language learning elements, but one thing was essential to the debate were strategy plans of looking for native speakers while accepting foreign resources. All of the 26 participants desired foreign resources as supplement to the self-study process with this precise materials.

In order to raise awareness for the future professional development it's important to mention one more study that discuss about self-reliant use of specialized program which was conducted in Murray's (1999) analysis with French learners who adopted simulated software program named Á la rencontre de Philippe. This software granted students to keep track of prearranged description lines in many distinctive paths, reacting to questions and comments from the leading character (Philippe) by choosing numerous text feedbacks. In Ulitsky (2000) examination participants were deeply inspired, autonomous learners who used a diversity of outdoor resources with software program, which showed that there were no learning results which could prove the programs efficiency.

Neither of the self-study software packages tested the use of the "all-in-one" commercial results (e.g., Rosetta Stone, TELL ME MORE, Pimsleur, etc.) which were advertised to self-reliant learners. Few reasons can be counted for this. First, because this packages were expected to be used as a substitute of in-person guidance more often than as additive to teacher-mediated classes, countless universities, which aim to be the ambience for CALL analysis, don't grant students to approach to them, but rather present them with additional

CALL materials. Additionally as result of the change in SLA to an interactionist way (Gass & Mackey, 2007), many CALL schooling worry how learners use technological devices for communication, such as, the amount of money spent on computed-mediated communication (Thorne & Payne, 2005; Sykes, Oskoz, & Thorne., 2008), or how explicit CALL functions can improve communication (González-Lloret, 2003) rather than assessment of software packages. Being said that, few references can be included to either Rosetta Stone or Auralog in CALL scholarship. In his analysis of trends in self-placed teaching Godwin-Jones (2007) indicate Auralog's TELL ME MORE and Rosetta Stone, explaining that "these programs are created around pre-planned classes with special objectives recommended in a continuous navigated track" and he continue noting that the audio, video, and speech recognition programs cause that this devices are probably really impressive (p.11). Lafford, Lafford and Sykes (2007) also mention commercially accessible resources which assess program for Spanish lexical addition. Lafford et al. (2007) adopts ideas of SLA to calculate the futures for a few various language learning products, that also includes products of Auralog and Rosetta Stone. Generally these authors have shown that majority of the Spanish CALL products have fail to construct the surroundings crucial for lexical acquisition, indicating explicitly that:

Rosetta Stone Spanish Latin America, and Auralog's *TELL ME MORE Spanish* have exceptional technological framework (such as great graphics, videos, pictures, and speech recognition program), but this products do not assimilate a number of previously featured observations (for instance the urge for culturally accurate, task-based actions) that SLA education might have provided them. (p.516).

Saury's (1998) notice one more Rosetta Stone presentation on constructing psychological base for assessment language learning program, where she mention that Rosetta Stone is "one of the few software programs created with attention of how multimedia can take advantage of psychological actions of language learning" (p. 6). Saury then compliments Rosetta Stone for "intentionally decontextualized" content in order so learners can shape internal exemplary of how language function. Nonetheless, this claims was made in 1998 and are established on Krashen's approach of natural learning, and it has collapsed out of support in recent SLA research. Even though the barrier among explicit and implicit learning and the consecutive progress of automaticity has not yet precisely formed, the belief that acquisition appear with language outside of background is not sustained.

There is broad clue that language learners desire backing, synergy, evaluation and convenient materials to profit from self-study. Nonetheless, not one of the courses on self-reliant learning explicitly looks at presently accessible commercial products who praise themselves as absolute result. Even though products are periodically discussed in SLA literature, there are opposing evaluations of their possible progress. Regardless of valid causes for this dearth of research (for instance countless universities do not grant approach to stand-alone software packages, majority of CALL analysis is concentrated on cooperation, self-study is not a simple field for analysis taking into account its discrete character), and there is no evidence from which it could determine how these products function and it certainly requires attention. Since the for-profit companies have labelled themselves as corporations and non-profit organizations as cure for learning languages, users, theorists, and language teachers should know the conditions under which these products operate and under what circumstances they should be used.

III. THE CURRENT STUDY

Since commercially accessible, stand-alone language products are not commonly settled in schools or universities, broad community of learners presently rely on these CALL resources: workers of the United States government (USG). Even knowing that there is considerable deal of high-quality, face-to-face language training is accessible to few USG workers- for instance, company-situated language training centers like Foreign Service Institute, and the Defense Language Institute Foreign Language Center- there are companies that absence with in-house language training and also with resources to deliver to all involved parties for off-site teaching. Rosetta Stone, TELL ME MORE and Transparent Language are products which have been used by companies across the USG because they are trying to discover a extensible result in order to make language learning accessible to people in which in-person guidance is illogical or impractical. The paper will address the outcomes of a two-part analysis organized by the University of Maryland Center for Advanced Study of Language (CASL) designed to raise the awareness and examine how mature learners in USG companies use technology-mediated self-study packages.

IV. CONCLUSION

Many elements can grant the progress of self-conducted learners, like learner-internal opinions and methods (Bown, 2006; White, 1999), the support accessible to learners (Murphy, 2008), how resources are being used (White, 2005), and also the content of the resources (Lafford et al., 2007). As a result of the sum of possibly confusing variables with self-study, and because media or design correlation investigations do not normally grant powerful discoveries (Blake, 2009; Surry & Ensminger, 2001), in order to show implication for the future professional development, the CASL investigators didn't established experimental agreement to measure self-study packages-to one another or to more classical designs of language training. Instead, course was created to explore self-directed learner usage and results on natural workplace settings in two diametric phases. The first phase (P1) inspected the usage of Rosetta Stone (RS) in Arabic, Mandarian and Spanish in distinguished government agencies, while the second phase (P2) inspected the usage of Auralog TELL ME MORE (ATMM) in Spanish by thr workers in the U.S. Coast Guard (USCG).

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Parents' Perception of the Needs for Implementing Measures for Child Protection on the Internet

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Abstract - ***Technological development has facilitated living in modern society in many ways, but it also had an impact on developing a new form of crime - cybercrime. That is why it is necessary to protect the children with statutory regulations, but parents also need to monitor how their children use the Internet and for what purpose. There is no legal act on a national level that regulates the safety of children on the Internet specifically, despite the amendments of the Criminal Code from 2003, which have stipulated that exploiting the computer network or communicating by other technical means, in order to commit sexual assaults against minors, (article 185b) is considered as a criminal offense punishable by the law. Therefore, it is necessary that children are recognized as a vulnerable group in the Strategy for Development of Information Security.***

I. INTRODUCTION

The Internet is an important invention of mankind which influenced all the other areas of modern life. Today, children at the same time represent a "digital generation", as well as a vulnerable group of the Internet users, who are facing potential risks. The fact is that children are often bigger experts than their parents in this field. On one hand, parents tend to improve their children's educational perspective by using the Web and, on the other hand, they are worried because of the risks that follow the use of the Internet and social networks. [1] Therefore, considering the value and educational potential of the Internet, which are probably not exploited enough, the fact is that it is often being talked publicly about dangers and risks of using the Web, in order to focus the attention on protecting and ensuring safe usage of these ways of communication. Nowadays, children start to use the Internet at an early age, accessing it via various devices (computers, tablets, mobile phones). It is estimated that there will be 50 thousand new users between the age of 5 and 17 in the Republic of Serbia (RS) by 2017. [2] Research shows that younger children use the Internet for entertainment (playing games, listening to music, watching videos, series and movies), while the older ones mostly use social networks. [3] In fact, four-fifths of the children aged between 10 and 18 have a profile on some of them. [4] Therefore, a special attention is directed to the safety of children on social networks. The main issue that follows the appearance and expansion of social networks, especially the Facebook, is the privacy issue. Facebook, Twitter and Myspace are only some of the most popular social networks, while the research shows that Facebook is most commonly used and it also provides options for privacy protection, but the users in RS do not use them so often. [3]

However, the expansion of the Internet as a free IT space, unfortunately, opens another space where content circulates freely and carries potential risks for children. Whether those risks refer to the possibility of children getting in touch with unfamiliar people who have bad intentions, to personal information abuse or other, there is a need for training everyone, and especially children and their parents, for using virtual space safely. But, not enough attention is paid to this issue in our society, which is evidenced by a small number of organized educations on how to be safe on the Internet, especially when it comes to the education of parents. That is why the data collected in the research based on this subject can have a great influence on recognizing the individual and social importance of this issue. It is essential to realize the amount of parents' perception on the safety of children on the Internet and social networks, whereby the control, "in the broadest sense, can possibly be operationalized as a process of monitoring and directing/regulating children's behavior and activities." [5] This process is connected to the parents' active searching for information about the child's activities and to setting up clear rules of behavior that should be the basis for safe use of the Internet. [6]

Within this work, the research has been carried out on a sample of 83 parents of the school children aged from 11 to 15 from the region of central Banat and the method that has been used is a survey. The attitudes of parents towards the issue of their children's safety on the Internet have been examined, because human factor cannot be singled out from this kind of relationship to the world where their children live, and their eventual practical operations.

II. THE RISKS OF USING THE INTERNET AND SOCIAL NETWORKS

Nowadays, children are exposed to various risks in the cyberspace and they have to be protected from: child pornography, child trafficking, cyber-bullying, etc. The United States Department of Justice estimated that in 2004 there were recorded between 14.500 and 17.500 cases of trafficking in the USA, wherein the Internet was used as an instrument for trade. [7] The special prosecutor for cybercrime, Branko Stamenkovic, allocates child pornography as a danger. [8] From 2009, an action called "Armagedon" is being carried out, and it is directed against people suspected for exploiting and abusing children for pornographic purposes on the Internet. Police authorities of the Ministry of Internal Affairs of the Republic of Serbia (MUP RS) and the Department for Cybercrime were involved in the international police operation "Delego", during which a person from Novi Sad, who is found with 10 gigabytes of child pornography, was arrested.[9] However, given that exploiting and abusing children for pornographic purposes, as well as data privacy, have been recognized as main risks of children using the Internet, the work of entities that are dealing with other risks on the Web has been marginalized. But, risky behavior on the Internet also includes addiction development, due to the increased time spent on the Web. [10] In a relatively short period, the Internet has become the most popular media among children. They gain excellent IT knowledge at an early age and because of that they are prone to the influence of this new media. It is also troubling that the Internet users entrust their personal information to strangers. The risk of violating privacy is obvious, considering the anonymity of the Web. The fact is that, by taking part in the Internet communities and even by searching the Web, every user loses his privacy to a certain extent, whereby the children are more likely to disclose their personal information. According to the research, even 31.1% of boys and 27% of girls aged from 9 to 15, point out that they shared their personal data on the Internet (e-mail adress, phone number and even their home adress). [11] Potential consequence of revealing personal information on the Web can lead to unwanted contacts out of the network, which can bring a child in physical danger. Also, social networks could be used for violence promotion. Regarding the category of the risky contact, it is important to point out that „cyber-bullying", which means harassment and bullying on the Internet, deserves a special attention because of negative consequences that it leaves on the individual, its emotional and social functioning. Cyber-bullying exists when a person or a group of people uses the Internet, mobile phones, online games, social networks or any other form of information and communication tehnologies (ICT) in order to threaten, harass or humiliate another person. Besides, it is the fact that this type of bullying can also happen in contact with peers and school friends and that is why it is harder to control this type of risk on the Web by using Internet filters. Another type of risky contact is sexual harassment on the Internet, which has become more common with the appearance of web cameras and programs for instant messages. [12] With the advent of social networks, which enable sharing photos, videos and texts, the risk of this type of contact has been increasing. Therefore, representatives of the European Commission and 17 social networks (including Facebook, Myspace, etc.) signed a contract according to which they will protect children from cyber-bullying and violence on the Internet together. In the USA, governors of 49 American states signed a contract about child protection with social networks. [13] This measure is understandable because cyber-bullying is happening often via social networks. According to the official statistics of the National Crime Prevention Council, half of the American teenagers are victims of cyber-bullying, while the research also shows that 81% of them consider it amusing. [14] Apart from cyber-bullying, the exploitation of children on the Internet, i.e. the exploitation via ICT, which implies "violence, exploitation, abuse and/or molestation of children by adults or peers,"[15] includes sharing indecent content with children, recruiting children for illegal activities, e.g. grooming, sexting and other types of violent behavior which threaten the children rights. Grooming is a process in which children are persuaded or encouraged to participate in interactions of sexual content via the Internet or phone devices, whereby they are exposed to unwanted pornographic contents. Sexting represents sending disturbing contents (explicit texts, photos, videos) via ICT to another person (most frequently via SMS, MMS, e-mail, Facebook, Myspace and other social networks and

chat-rooms). Based on the research carried out by the Provincial Ombudsman, data was received from the police departments (PD) in APV, i.e. from the police stations on their territory, about the number of reported, denied and processed cases during 2011 and 2012. The data shows that two cases of child exploitation on the Internet were reported on the territory of PD Zrenjanin. One case was about cyber-bullying, wherein perpetrators were children, and the other case refered to sexting. [15]

According to the survey data collected by the Institute for Psychology in Belgrade, 62% of older elementary school pupils and 84% of high school students were exposed to risks in cyber space in 2011. [4] The research was based on a survey and it included 34 schools (17 elementary and 17 high schools), i.e. 3786 pupils, 3078 parents and 1379 teachers. Women were more prevalent among parents and teachers. Based on this research, it was determined that the most widespread risks are: accepting friend requests from strangers (43% of elementary pupils, 71% of high school students), sharing personal information on profiles (29% of elementary pupils, 39% of high school students) and responding to messages from strangers who want to get in touch with the child (27% of elementary pupils, 47% of high school students). It can also be noticed a higher readiness of older children to meet in person with the people that they get to know on the Internet. During 2014 and the first half of 2015, the Net Patrol, an online mechanism for reporting digital violence within the Safe Internet Centre Serbia, [16] received 1690 reports for abuse and harmful contents for children which were forwarded to the Department for Cybercrime within the Ministry of Internal Affairs of the Republic of Serbia and to INHOPE, http://www.inhope.org/gns/home.aspx, an International Association of Internet Hotlines, for further investigation and treatment. [17] Thereby, most of the reports sent to the Net Patrol by users, refered to the web pages that are not registered in Serbia.[18] Apart from Net Patrol, all sorts of digital violence could be reported at the Provincial Ombudsman website. www.bezbedaninternet.ombudsmanapv.

On the basis of what has been presented, it is clear that the Internet can be a potentially unsafe space. Risks for children on the Web are getting more noticeable and recognizable in modern society. Thus, that demands adequate and efficient systems of prevention and child protection and because of that, numerous legal acts and regulations have been adopted, both within the international law and national legislation. Parents, as the most important factor in education of children, need to be aware of the children's behaviour on the Internet, so they could ensure the benefits of its usage.

III. LEGAL ASPECTS OF CHILD PROTECTION ON THE INTERNET AND SOCIAL NETWORKS

With passing of the Law on Ratification of the United Nations Convention about children's rights, the Republic of Serbia pledged to take measures for preventing all kinds of violence within the family, institutions and wider social environment and to ensure child protection from them. [19] The Convention on the Rights of the Child was adopted on 20 November 1989, by the Resolution 44/25 of the United Nations General Assembly. It is the first international legal document which contains the catalog of all the children's rights. The concept of the child is defined by the provision of the Article 1. of the Convention on the Rights of the Child. A child is every human being under eighteen years old, unless the majority is attained earlier, according to the law applicable on the child. By the provisions of the Article 19, it is presribed that member states have to undertake all the adequate legislative, administrative, social and educational measures, in order to protect the child from all forms of physical and mental violence, violation or abuse, neglecting or careless attitude, bullying and exploitation, as well as from sexual abuse, while the child is in care of parents, legal guardians or any other person responsible for the child. All member states are bound to protect the child from all forms of sexual exploitation and abuse, according to the provisions of the Article 34.

The Republic of Serbia is a signatory to two European Council conventions: Convention on Cybercrime (adopted in Budapest in 2001) [20] and Convention on Protection of Children against Sexual Exploitation and Sexual Abuse (Lanzarote Convention) [21], which define legal mechanisms and instruments that could be used by countries in order to fight against sexual violence over children in cyberspace. The Convention on Cybercrime came into force in 2004 and apart from this convention, RS in 2005 signed, and in 2009 ratified an Additional Protocol to go with it. The Convention on Cybercrime of the Council of Europe from 2001 represents the first international document where child pornography and computer systems are explicitely associated. Its importance, among other things, is in creating special state authorities specialized for fighting against cybercrime. In 2005, the Expert Committee of the European Council started drafting the Convention on Protection of Children against Sexual Exploitation and Sexual Abuse and in October

2007 in Lanzarote (Spain) there was a signing ceremony of this convention which represents the first international instrument refering to all forms of sexual violence over children. The Lanzarote Convention came into force in 2010 and RS, by its ratification at the same year, became a contracting state, which means it has overtaken very clear obligations in implementing the Convention and in overall child protection from all forms of sexual exploitation.

After the ratification of the Convention on Cybercrime and the Additional Protocol, in our country were created the Criminal Procedure Code [22], the Law on Organization and Jurisdiction of Governement Authorities in Supression of Cybercrime [23] and the Criminal Code (CC). [24] Namely, while fighting against cybercrime, it was created a need for engaging special techically trained experts, but also for a different organization of state authorities. Within the Law on Organization and Jurisdiction of Governement Authorities in Supression of Cybercrime, for the first time in RS, there were predicted authorities for fighting against it. The Republic of Serbia has a Department for Cybercrime within the Ministry of Internal Affairs and also a special Department of the Higher Public Prosecutor's Office in Belgrade for the territory of RS, while a special jurisdiction for cybercrime is defined on a court level, through an individual department within the Higher Court in the first instance and a special department of the Court of Appeal in Belgrade in the second instance. However, after adopting the Law on Information Security (LIS), jurisdiction of these authorities should be expanded according to its provisions. [25] In our country, people from all social structures act as perpetrators of these criminal acts, so a single profile of the offender cannot be created. [26]

One of the relevent documents for protecting children from violence is the General Protocol on Protection of Children from Abuse and Neglect, which was adopted by the Government of the Republic of Serbia.[27] However, there is no legal act in RS that regulates the safety of children on the Internet specifically, although according to changes in the Criminal Code, using computer network or communicating via other technical means, in order to commit sexual assaults against minors (article 185 b), is defined as a criminal act. According to this, anyone who persuades another person to commit criminal acts of: Raping (article 178, paragraph 4), Sexual intercourse with a helpless person (article 189, paragraph 3), Sexual intercourse with a child (article 180, paragraphs 1 and 2), Sexual intercourse by abuse of position (article 181, paragraphs 2 and 3), Illicit sexual acts (article 182, paragraph 1), Procuring or enabling sexual intercourse (article 183, paragraph 2), Facilitating prostitution (article 184, paragraph 3), Dissimulating, obtaining and owning pornographic material and exploiting children for pornography (article 185, paragraph 2) and Persuading minors to witness sexual intercourse (article 185a); or the ones who use computer network or communicate via other technical means, in order to settle a meeting with a minor and actually show at the agreed place, will be sentenced from six months to five years in prison and a fine. If this act was commited against a child, the prison sentence would be from one to eight years. The most important change is that the Criminal Code, for the first time, considers as a criminal act owning and obtaining photos, audio-visual recordings or other items of pornographic content created by exploiting minors.

In the National Youth Strategy for the period from 2015 to 2025, it is stated that the development of security culture (including cyber as well) is one of the strategic goals. [28] However, this only refers to the children older than fifteen. At the beginning of 2016, in the Republic of Serbia was adopted the Law on Information Security (LIS), Body for the Coordination of Information Security and a work group for writing the Strategy for the Development of Information Security, so it was created a space for improving legal and institutional framework. However, LIS refers only to legal entities and it is predicted that its numerous issues would be regulated by subordinate legislation. When LIS was adopted, it had all started from the need to improve legal and institutional framework for the information security [29] and the need to increase the awareness level of citizens about incidents and risks in cyberspace. [25] LIS predicts founding of the National Centre for Prevention of Safety Risks in ICT systems (Computer Emergency Response Team (CERT), placed within the Regulatory Agency for Electronic Communications and Postal Services (RATEL). The National CERT received authority over collecting information, classifying information about incidents and risks, raising public awareness and cooperation with public and business entities (article 15). Also, LIS predicts establishing of the Body for the Coordination of Information Security (Body for Coordination) which was founded on 8 March 2016. However, it was planned that representatives from only several state institutions should be a part of it, above all from the Ministries of Trade, Tourism and Telecommunications, Defence, Internal and Foreign Affairs, then from the security services, as

well as from the National CERT, but not from the Ministry of Education, Science and Technological Development. Still, LIS predicts a possibility of establishing special working groups within the Body for Coordination, which will be created when needed, for certain specific issues. It is also necessary that children are recognized as a vulnerable group in the Strategy for the Development of Information Security and that the special working groups, that will be formed within the Body for Coordination, carry out the evaluation of former projects. In theory, this is considered to be a precondition for formulating a unique approach to the issue of children's exposure to safety risks on the Internet and for creating a coordinated national campaign, which should contribute to the raising of knowledge of children, parents, guardians and teaching staff about safe ways of using the Internet. [26]

In recent years, national conferences about children's safety on the Internet are being organized, where existing conditions are being analyzed, as well as the next steps in this field. Although it is considered that insufficiently defined space for public-private partnership is a serious flaw in the existing legal framework, [30] the only comprehensive partnership exists in the form of the Safer Internet Center and the campaign "Click Safely" which involves the competent ministry, telecom operators and other actors, as well as the Foundation Fund B92, in the project for reporting illegal and harmful online content. [31] Within the campaign "Click Safely", which is being carried out by the competent ministry under the name "Think Before You Post", trainings for the teaching staff, pedagogical-psychological services and parents' councils were organized in all schools in RS. From the very beginning, experts from Telekom Serbia also participated in the campaign by educating children, their parents and teachers on debates in schools all over RS, together with the ministry representatives. Otherwise, February 7 is celebrated as the Safer Internet Day in the Republic of Serbia.

IV. PARENTS AS ENTITIES OF PROTECTING CHILDREN ON THE INTERNET AND SOCIAL NETWORKS

Parents who monitor activities of children on the Internet are trying to control what their children are doing in many different ways. The research carried out in 2006 by the Pew Internet & American Life Project showed that: 85% of parents imposes rules for children while using the Internet; 65% of them checks what their children are watching on the Web; 53% uses some kind of software for filtrating and 45% uses a software for monitoring. [37] There is a whole range of websites that are advising parents on how to protect their children on the Internet: www.kidshealth.com, www.protectyourkids.info, www.safefamillies.org, www.bbesafe.com. Apart from the websites, popular Internet filters are: netnannyfilter, k9 Web protection and other. Also, there are many sites that are warning parents about the ways to protect their children from cyber-bullyinga: www.stopcyberbullying.org, www.safekids.com, www.howtostopcyberbullying.com, www.cyberbullyalert.com, www.stopbullyingnow.com.

The research of the Institute for Psychology in Belgrade showed that children are aware of the fact that there are ways to protect their privacy on social networks, which should serve as a base for furher steps. The same research indicated that girls and older pupils are more interested in learning about the ways of protection on the Internet, comparing to the boys and younger pupils. There was also identified a lack of awareness of parents and teaching staff about concrete measures of prevention and protection from the risks. [4]

In mid-2010, the company Telenor Serbia signed an agreement with the Ministry of Internal Affairs of Serbia about the strategic cooperation, with the goal to install filters for blocking access to illegal websites with elements of sexual abuse of children. In 2009, the Ministry of Telecommunications and Information Society, within its jurisdiction, took the initiative for improving the safety of children on the Internet in the form of the previously mentioned project of starting the website "Click Safely", where children and parents could find different informational, educational and entertaining contents, from which they could learn something more about the safe use of the Internet.

V. RESEARCH METHODOLOGY

The subject of the research is parents' position on the issue of their children's safety on the Internet, i.e. their perception of the needs of implementing certain measures of protection. The research goal is to establish the opinions and behavior of the parents in context of the new life environment for their children, and to be aware of the necessity of their own personal involvement in it, in order to prevent its negative effects. The quantitive method which was used to carry out the research is a survey in a narrow sense, about attitudes and opinions of the examinees' parents. Conducting of this quantitive research enabled precise measuring and quantifying of the relevant

indicators. The value of this survey is limited because the information received in it depends on honesty of the examinees' parents and their ability to answer fairly to the questions asked. It is possible that the survey method is subject to epistemological and social limitations, in the sense that the examinees do not answer how they really mean, but according to the social values or their unawareness of the matter. That is why a survey is considered only as one of the phases in the research process, without neglecting other aspects of the research.

The technique used for collecting the information is the indirect survey, i.e. a questionnaire which is consisted of twenty, mainly closed-ended questions, whereby the first six of them are about personal information about the examinee (sex, level of education, age, place of living, employment, number of children in the household). It was also detected if the parent itself uses the Internet and if he/she has a profile on social networks.

The following questions were about monitoring children's behaviour, the ways and frequency of their usage of the computer and the Internet (Internet access; position of the computer; time, frequency and the amount of time spent in front of the computer). Then, it was examined which activities the child carries out on the Web (learning, games, movies, music, social networks....). Next, it follows a group of sensitive questions. The parents were asked if their child shares personal information on the Internet and if they consider that this is followed by some risks. They were also asked if their child had some unpleasant experiences on the Internet and if he/she was upset about it. The essential part of the survey were the questions about the parents' opinions about their level of familiarity with the ways of using the Interrnet safely and about their capability to help their child to cope with any problem of this kind – which concrete measures are they taking in order to protect their child and do they think they need institutional support in that field.

The questions were closed-ended with the simplest form of YES/NO answers, as well as with one or more offered answers. It was also given a possibility to write additional answers which were not offered, but the parent found them true.

VI. RESEARCH RESULTS

The research indicated that parents allocated their „conventional and usual social fears and concerns in a new, unknown cyberspace". Simply put, the impression is that parents just moved their familiar and traditional fears to the one, relatively new and, to them, insufficiently familiar context, as it was detected in the research carried out by Unicef in 2016, about the level of awareness, potential internet risks and misuse among the parents of children aged between 8 and 17. Parents expressed concern that their children are threatened on the Internet and that they need help in this field. Most of the parents declared that they are not worried about sharing personal information on the Internet, but they are surely against their children meeting in person with the people they met on the Web, which tells us about how much these two indicators are not brought in connection directly. Even a remarkable number of them finds that they need institutional support from the state, which will be carried out by organized education of parents. However, surprising is that the majority of parents answered that they are not currently involved in the activities of their children on the Internet, i.e. they are not taking concrete actions in order to protect their child (55%). Only 11 % of them checks how their child is behaving on the Web and even 48% said that they do not know if they are capable of helping their child to protect itself from dangers on the Internet.

On the basis of this research, we came to a conclusion that parents do not have a certain perception of the dangers to which their children are exposed to on the Internet and that the vast majority of them is confused and uninformed about the ways of protecting children and the fact they need institutional help for it.

VII. CONCLUSION

Children should be protected on the Internet and social networks, so they would not become victims of cybercrime. Their protection, as a vulnerable group, should still be regulated with legal acts within the new security field. Also, it is important to include child safety on the Internet in the future Strategy for Development of Information Security of the Republic of Serbia, which would lead to the strenghtening of the legal framework and the capacity of institutions that are dealing with children. There is no legal act or strategic document on international or national level that regulates the safety of children on the Internet specifically, but changes of the Criminal Code from 2003 defined that exploiting the computer network or communicating by other technical means, in order to commit sexual assaults against minors (article 185b), is a criminal offense punishable by the law. In both international and domestic regulation and strategic framework, computer systems and information and communication technologies (ICT) are mentioned

only as a medium or a way for sexual exploitation of children. That is why competent executive authorities approach to this subject mainly from a criminological point of view, so they are more focused on supressing this phenomen, after it had already happened, and on punishing the perpetrator of the sexual exploitation offense, who also used ICT, when dealing with this issue. A better solution would be a prevention of the issue, by informing children and parents and educating them about proper use of ICT and appropriate preventive protection. Cyber-bullying, characteristic for more and more frequent peer violence via ICT among children, as well as grooming and sexting, are not recognized in any way as individual types of violence over children. In this regard, for the purpose of preventing and supressing violence over children via ICT, it is necessary that the existing legal framework improves and that obligations, from the accepted international contracts that our country signed, are implemented in positive legal regulations of the Republic of Serbia

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Ranking Educational Web Sites for Web Design by Using Fuzzy Screening Method

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Abstract – Internet evolution has led to rapid growth of students that use educational Web sites. Usage of educational Web sits in higher education is topic of numerous debates and researches. This paper presents a study aimed at using Fuzzy Screening method for ranking educational Web sites for Web design based on criteria extracted from relevant literature. Ranking of educational Web sites is based on experts' opinions. Web sites ranked by this method can be used as regular learning materials.

I. INTRODUCTION

Web Based Learning (WBL) is a way of teaching and learning in virtual environment [1]. It makes possible organizational, methodic and content improvement of educational activity. Schank [2] tried to explain the key points that would make up teaching process in virtual learning:

- People need to be motivated to learn.
- People must experience fail to have a motive to learn.
- Learning must be fun.
- Learning should be the foundation of everything else in life.

Consequently, WBL based on educational Web sites achieves:

- Needed quality of teaching material presentation;
- Motivation and maximal activity of students;
- Constant connections teacher-educational web sites-student, and student-educational web sites-teacher, therefore helping students in their work in due time;
- Efficient work process and receive of information, fostering efficient exercises and evaluation of students work;
- More possibilities for teacher in preparing, directing and following teaching, easier communications with students, more efficient and prompt giving of needed help and full objectivity in the process of student evaluation;
- Conditions for more efficient application of multimedia in teaching.

Application of Web sites for educational purposes provides better conditions for maximal visualization in teaching, rational usage of resources, time, staff, and permanent testing and verification of student knowledge [3].

Educational Web sites for Web design contributes to more efficient solving of practical problems and if it is strongly connected with other aspects of organization they increase the quality of teaching and interests of students in a given context.

II. FUZZY SCREENING AND OWA OPERATOR

Fuzzy Screening method is procedure useful in environments in which we must select, from a large class of alternatives, a small subset to be further investigated [4,5]. This method is based on usage of linguistic terms for describing experts' opinions by using words like: High, Low or Medium. The approach allows subjective opinion for each expert [6]. By using this procedure each alternative is evaluated, so the more valuable alternative is placed on the top of the list for specified group of criteria. If an attribute (A) took a value from a set $\{a_1, a_2, a_3\}$, and the values of each attribute are determine as

$$a_1 \leqslant a_2 \leqslant a_3,$$

then attribute A is called a ***criteria***.

There are three components in Fuzzy Screening

Method (FSM):

Set **X** of p alternatives.

Set **E** of r experts.

Set **C** of n criteria.

Using this procedure each alternative is evaluated by each expert for satisfaction to its multi-criteria selection function. In this case, we can use a scale S with m values. The elements of scale S are linguistic terms defining fuzzy function of affiliation. Usually triangular function of affiliation is used, but other functions such as trapezoidal, gaussian or sigmoidal function can be also used. In that case, for scale S the following applies:

$$S_i > S_j \text{ if } i > j.$$

The same can be applied for every two values in scale S:

$$max(S_i, S_j) = S_i \text{ if } S_i \geq S_j,$$

$$min(S_i, S_j) = S_j \text{ if } S_j \leq S_i.$$

Very important is to define negative values for scale S, so we can enable calculation for expressions like: ***not high*** or ***not low***, etc. The way to calculate negation of values in scale S is:

$$neg(S_i) = S_{m-i+1} \qquad (1)$$

Implementation of FSM can be done in five steps:

1. Defining a scale S with m linguistic variables.
2. Defining a table where every element consist value of specify criteria for given alternative.
3. Every expert uses scale S for evaluating all criteria.
4. Every expert uses scale S for evaluating all alternatives, in the way that he/she evaluates every alternative by evaluating satisfaction of each individual criterion.
5. The total of all scores U for each alternative and for each expert is calculated in the following way:

$$U = min_j\,(neg(I_j) \vee s_j) \qquad (2)$$

In formula (2) I_j is the importance of j-th criteria, s_j the assessment value of j-th criteria provided by an expert, in which case disjunction is defined by function max. Because results U are calculated for each expert individually, we have r scores for each alternative, were r represents the number of experts. The finale score for every alternative is calculated by the aggregator. Most commonly used aggregator in FSM is OWA (Ordered Weighted Averaging) operator.

Yager [4,7–9] introduced OWA operator, where the first step in process of aggregation is for the decision making body to provide an aggregation function Q. This function can be seen as a generalization of the idea of how many experts it feels need to agree on an alternative for it to be acceptable to pass the screening process. In particular for each number i, where i runs from 1 to r, the decision making body must provide a value $Q(i)$ indicating how satisfied it would be in passing an alternative that i of the experts where satisfied with. The values for $Q(i)$ should be used from the scale S. In order to define function Q, we introduce the operation $Int[a]$ as returning the integer value that is closest to the number a. In the following, we shall let q be the number of points on the scale and r be the number of experts participating.

This function, which emulates the average is denoted as $Q_A(k)$ and is defined by

$$Q_A(k) = S_{b(k)} \qquad (3)$$

where

$$b(k) = Int[1 + (k * (q-1)/r)] \qquad (4)$$

for all $k = 0, 1, \ldots, r$.

Having appropriately selected Q we are now in the position to use the OWA method for aggregating the experts' opinions. Assuming that there are r experts, each of them has a unit evaluation for the i-th project denoted X_{ik}.

The first step in the OWA procedure is to order the X_{ik}'s in descending order, thus we shall denote B_j as the j-th highest score among the experts unit scores for the project. To fund the overall evaluation for the i-th project, denoted X_i, we calculate

$$X_i = max_j\,(Q(j) \wedge B_j) \qquad (5)$$

In order to appreciate the workings for this formulation we must realize that:

- B_j can be seen as the worst of the j-th top scores.
- $Q(j) \wedge B_j$ can be seen as an indication of how important the decision maker feels that the support of at least j experts is.
- The term $Q(j) \wedge B_j$ can be seen as a weighting of an object j best scores, B_j, and the decision maker requirement that j people support the project $Q(j)$.
- The max operator plays a role of the

summation in the usual numeric averaging procedure [4].

III. CASE STUDY

This section presents a study aimed at ranking Web sites for Web design. The first subsection briefly describes the methodology. The research process and results are presented in the next two subsections.

A. Methodology

Increased Internet access in the past decade has led to a rapid increase in the number of students electing to undertake their higher education learning experience online, rather than in traditional face-to-face settings [10,11]. Therefore, teachers must seriously consider Web based learning materials in their teaching practice. Mixing educational web sites with regular learning materials can contribute to students' productivity in their search for knowledge.

The objective of this study is to rank educational Web sites, making student decisions in learning more efficient and reliable. The primary assumption is that there are too many Web sites that deal with the topic of Web design. By using FSM we can rank educational Web sites that are most suitable for students' education.

Implementation of FSM is done in the following five steps:

1. Defining scale ***S*** with ***m*** linguistic variables.
2. Defining alternatives and specifying the most appropriate criteria for given alternatives.
3. Every expert, by using scale ***S***, evaluates all criteria.
4. Every expert, by using scale ***S***, evaluates all alternatives, in the way that he/she evaluates every alternative by evaluating contentment of individual criteria.
5. Calculation of total score for each alternative based on scores obtained by each expert.

B. Research process

Before taking any of these steps, we have to select experts who can give their subjective opinion on this matter. For study, we selected three experts who are teachers on subjects related to Web design at Technical Faculties, so that their opinions can be regard as relevant.

Step 1.

In case of this research the scale ***S*** is defined with five values: S_1 – Very Low (VL); S_2 – Low (L); S_3 – Medium (M); S_4 – High (H); S_5 – Very High (VH).

Step 2.

The alternatives are selected by using four different search engines: Google, Bing, Yahoo and DuckDuckGo. The first five results that have match on all four search engines were selected. The search was conducted by using "*tutorijali za html i css*" key words (key words are defined in Serbian). With defined key words, we got the next alternatives:

A_1 – https://www.w3schools.com/

A_2 – http://tutoriali.org/

A_3 – http://htmldog.com/

A_4 – http://webarena.rs/

A_5 – http://www.tutorijali.rs/

For these alternatives, we selected four different criteria. Criteria were selected from study conducted by Rakesh Garga and Dimpal Jaina [12] and used at the highest level of grouping as follows:

C1 **General Factors** (Applicably in Phase; Required Time; Required Valuators; Required Equipment; Immediacy of the Response; Information Provided)

C2 **Functionality** (Suitability; Accuracy; Interoperability; Complacence; Security)

C3 **Personalization** (Learning Progress; Learning Performance)

C4 **Usability** (Understandability; Learning ability; Operability)

Step 3.

This step consists of experts' subjective opinions on evaluating all criteria by using scale S, which is shown in Table I.

TABLE I. EXPERTS EVALUATION OF CRITERIA

	C_1	C_2	C_3	C_4
E_1	M	M	VH	H
E_2	M	L	H	VH
E_3	M	L	H	VH

Step 4.

Results of how individual experts rated alternatives by evaluating contentment of individual criteria by using scale ***S*** is shown in Tables II, III and IV respectively.

TABLE II. EXPERT 1 EVALUATION OF ALL ALTERNATIVES BASED ON EACH CRITERIA

	C1	C2	C3	C4
A1	M	H	VH	H
A2	L	H	H	M
A3	L	M	M	H
A4	M	L	M	M
A5	L	M	L	M

TABLE III. EXPERT 2 EVALUATION OF ALL ALTERNATIVES BASED ON EACH CRITERIA

	C1	C2	C3	C4
A1	H	H	VH	VH
A2	VL	M	L	VL
A3	H	L	M	H
A4	M	M	VL	L
A5	L	M	L	L

TABLE IV. EXPERT 3 EVALUATION OF ALL ALTERNATIVES BASED ON EACH CRITERIA

	C1	C2	C3	C4
A1	H	H	VH	VH
A2	L	L	VL	M
A3	M	M	H	H
A4	H	M	M	M
A5	L	M	L	M

Step 5.

In this step total scores for all alternatives are calculated based on scores obtained by each expert using (1) and (2) formulas, and aggregated by using formulas (3), (4) and (5), which is shown in Table V.

TABLE V. TOTAL SCORES FOR ALL ALTERNATIVES BASED ON SCORES OBTAINED FROM EACH EXPERT

	E1	E2	E3	OWA
A1	M	H	H	H
A2	M	VL	L	L
A3	M	M	M	M
A4	M	L	M	M
A5	L	L	L	L

C. Discussion of the results

Using the results obtained buy FSM we get the list of ranked alternatives based on the selected criteria:

A_1 – https://www.w3schools.com/

A_3 – http://htmldog.com/

A_4 – http://webarena.rs/

A_2 – http://tutoriali.org/

A_5 – http://www.tutorijali.rs/

Based on the results, we conclude that the alternative A_1 is the best educational Web site for students, alternative A_3 and A_4 are the second-best solution for education of students, while, alternatives A_2 and A_5 receive the lowest rank from the experts.

IV. CONCLUSION

Web sites ranked by using FSM may be used as educational material in several courses oriented towards Web design since their ranking is based on experts opinions. Their use might improve connections teacher - educational web sites - student, and student - educational web sites - teacher. In addition, it might be helpful for improving quality of education. Using experts in this method gives it corresponding legitimacy that the content of educational Web sites is appropriate for student. The list of ranked Web sites, obtained by using this method gives student an advantage of learning from the best online materials that are available on Internet. The case study confirms that FSM can be applied for selecting educational sources. However, for more reliable usage of this method in education, the number of expert must be bigger, as well as the number of alternatives and criteria.

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Training of Medical Staff Using the Internet Service

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Abstract - Today, the application of information technology in health institutions of the Republic of Serbia is becoming a reality. In late 2003 and early 2004 began the implementation of information systems that enable electronic invoicing services in health institutions and generate electronic invoices to the Republican Fund for Health Insurance. From then until now, largely advanced in terms of the scope of application of information technologies.

I. INTRODUCTION

The aim of this study is to analyze the impact of the application of information technology on the quality of work, and improvement in terms of opportunities for professional development of health professionals using the Internet. Impact of information technology is viewed from the aspect of different age groups, taking into account both younger and older generations of workers. Although it is already well-known fact that the older generation harder to accept new technologies and changes in work, this work is an attempt to prove that the use of internet services in a drastic measure changed their way of working and thinking.

The main objective is to develop through their implementation of information systems that will reduce the possibility of errors in health care workers and thus improve the quality level of Health care provided to patients.

Through this methodological research analyses the state of consciousness and different aspects of thinking of health workers, the changes in their work processes, and individual experiences that individuals have regarding the use of information technology.

II. THEORETICAL RESEARCH

Implementation and use of the results of informatics in biomedical sciences, medical practice or in the provision of health care, began almost simultaneously with the formation of these results, Hollerith (Herman Hollerit, 1890) punched cards as information technology in epidemiological and public health research have been used at the end of the at the beginning of this century, the first scientific work in the field of medical informatics was printed in 1959 in the journal Science, a journal in our National health 1970. The increase in the number of published scientific papers, featured in recent years, has caused since 1992, and regular publication of the (Yearbook).

Taking into account the fact that the implementation of internet services in the health sector of the Republic of Serbia began, less than a decade, some of the research that has been done in this field of science are:

- Researching on ICT Portal. Council entitled 'Council Student medical informatics, "which includes a detailed description of medical informatics and definition of medical informatics as a science of the future.
- Research by students of the Faculty of Medicine, with the theme "Implementation of medical information systems in education and researches in medicine." It includes the definition of the standard functionality of medical information systems, as well as the connection of various types of medical information systems. Also an important aspect of this research is, and that the medical information systems play an important role in educating health professionals and application of medical information systems in scientific research papers.
- Various articles relating to the electronic medical record of the patient, such as an article in the magazine "Computer World" called "Online Patient".
- Various investigations relating to components of information technology in health care

III. PRESENTATION OF FINDINGS

To obtain research based on which will be observed problems and determine the situation in the field of information technology and the application of Internet services. He was elected a Health Centre ,,Zitiste" different in the structure of employment (in terms of qualifications, seniority, working conditions), enabling the comparison of the results obtained by the survey

Employees who were working that day were surveyed. The first group of questions is planned to determine the structure of the respondents. It was concluded that, in the two tested samples, the structure of the surveyed different by gender and level of workers. Non-medical workers are not covered by the survey. The total number of respondents was 45, of which 16 doctors and 29 nurses.

Taking into account the fact that each doctor works with two sisters in a shift, it is logical that the number of nurses is greater than the number of doctors. Doctors are different specialties. Among them are general practitioners, specialists in gynecology, internal medicine specialists, etc. Nurses are also different profiles. The following table, shows the total number of medical workers who were surveyed.

TABLE I. TOTAL NUMBER OF HEALTH WORKERS SURVEYED

Total number of staff surveyed:			
Personnel	In total	Surveyed	%
Doctors	16	45	35,55
Nurses	29		64,45

Taking into account the fact that each doctor works with two sisters in a shift, it is logical that the number of nurses is greater than the number of doctors. Doctors are from different specialties. Among them are general practitioners, specialists in gynecology, internal medicine specialists, etc. Nurses are also different profiles.

Question number 2, is: Do you have a computer in the workplace? Answer of workers on this question is presents in the table:

TABLE II. TOTAL NUMBER OF HEALTH WORKERS WHO POSSESS A COMPUTER

The number of workers who have a computer					
Personnel	Have	Not	Br. interviewed	% (Have)	% (Not)
Doctors	16	0	16	100,00%	0%
Nurses	27	2	29	85,50%	14,50%

A very important factor in the analysis of the application of Internet services in health care workers makes their age range, in fact, visible to the older generation, to a lesser extent using the younger generation. To be able to adequately perform the analysis of the results, it was necessary to give the workers surveyed health not only by trade, but also by ages.

TABLE III. TOTAL NUMBER OF HEALTH WORKERS BY AGE STRUCTURE

Age structure						
The age range	18 - 25	26 - 35	36 - 45	46 - 55	56 - 65	>65
Total respondents	7	8	8	11	9	2
Percentage	15,55	17,77	17,77	24,44	20,00	4,44

When asked whether they use online services for their professional training, health workers have responded as follows:

TABLE IV. USING AN INTERNET SERVICE FOR PROFESSIONAL DEVELOPMENT

	The total number of respondents	**Affirmative answer**	**Negative answer**
Number	45	16	29
Percentage	100	35,55	64,45

Trainings every employee is a priority. Only appropriately qualified workforce can provide good results at work. Medicine is very specific in this regard, namely, every day we are witnessing new medical discoveries that have been developed for years or perhaps even decades. The result of the analysis of responses clearly shows that traditional ways of vocational training and further topical representation of training through computer.

Health workers have responded to their electronic medical records greatly helps in collecting, recording and analyzing health data on patients: To the question: To what extent do you believe the health information system reduced their possibility of errors in diagnosis, medical workers responded as follows:

- no - 9%
- very little - 11%
- significantly - 33%
- very many - 13%
- very much -33%

IV. CONCLUSION

Respondents in their surveys confirm our hypothesis concerning the positive impact of the application of Internet services on the quality of work.

Obviously, it can be said that most health professionals believe that their health information system helps in the performance of its business activities as well as to the possibility of error when carrying out their activities greatly reduced which automatically improves the quality of work, on the basis of these data, we conclude that set the main hypothesis proved to be correct.

There is some knowledge about the ways of professional development using the Internet, and it can be said that health workers are familiar with the ways of acquiring professional knowledge using the Internet, but to date the application of the Internet is not overtaken in the way of professional training for health workers

V. ACKNOWLEDGMENT

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Mind Map as a Teaching Tool

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Abstract - The paper deals with the main characteristics of Mind Maps and the possibilities of their use in education. Examples of different maps are presented along with the experiences of their use in real classrooms. Mind Maps were used as a presentation tool, as well as for teaching and learning. They were used from the kindergarten through elementary and high school to university level. Each presented Mind Map consists of certain amount of information, relevant to its topic and its construction differs according to the age of the students.

Since Mind Maps are not yet widely known and accepted teaching tool, they are still rarely used in classrooms. Sometimes they are even misused. The paper consists of the main directions for making and using Mind Maps in the most effective way, based on the authors` experience gained by many years long use. Proper use of Mind Maps showed their efficiency, flexibility and many other precious effects noticed by the teachers and the students. These effects are also presented in the paper.

I. INTRODUCTION

A Mind Map is a special type of diagram that was invented and patented by Tony Buzan [1,2].

These diagrams are colorful and consist of pictures and words that are placed on the curved branches (see Figures 1, 2, 3, 4). The branches start in the middle of the paper, emerging from the central image. The central image represents the topic that is presented by the mind map. Mind Map is grammar-less and has only the associations in the form of the key-words or pictures.

Creation of a Mind Map involves all our senses and develops our creative thinking. Thus, many of our brain centers are activated and both brain hemispheres are synchronized [2].

The use of Mind Maps is possible in all situations that are connected to better thought organization such as learning, creative thinking, memorizing, decision-making, speech preparation/presenting and many others. Mind Maps are intended to make thinking process easier and more creative and efficient.

II. MIND-MAPS IN CLASSROOM

Each level of education mainly consists of learning that includes presenting, organizing, concentrating, memorizing, communicating, overviewing etc. Mind Maps could be incorporated in all these thinking processes [3, 4, 5, 6, 7].

There are [1, 8] some basic rules of constructing the Mind Maps. At the beginning, one (the teacher, as well as the student) should accept these basic rules. As he/she becomes experienced in using and constructing his/her own maps, the maps can be adjusted to the personality and particular needs. In that way, the maps show personal `handwriting` of the author. Anyway, the maps that are created for the others should be made according to the basic rules.

Our experience of using Mind Maps in classroom is positive [7, 8, 9]. Here, we present some of the main recommendation based on our experience. We have used Mind Maps as a teaching tool during real situations, in different schools, on different levels, according to official school programs. The students that were involved in this type of work were without any prior experience in using Mind-Maps.

Mind Map could be prepared and drawn in advance. But, we found that the best way is to draw the map in front of the class. That way, the students that are not familiar to the use of Mind Maps can witness and contribute during the construction of the map. The students easily and readily accept this way of presenting the lesson. They are involved in finding the right associations, key-words and drawings that are then placed on the map. In this way, not only the teacher, but also the students are authors of the presented lesson. They easily remember the unique way of their common-made notes in the form of the map.

The Mind Map can evolve completely during one class, or it can be developed during consecutive classes that deal with the same topic. Construction of further branches does not disturb

earlier drawn ones. The structure of the map can grow without any restrictions.

Technically, using Mind Maps does not make any problems. Teacher should use blank paper which should be as large as possible. The paper can be attached to the blackboard. Or, the process of the teacher's drawing could be projected by the video-beam or any other type of presentation, on the wall. Students should draw the map together with the teacher, or they could copy the map at the end of the class. Student's map should be drawn on the landscape oriented blank paper (at least A4 size). The only recommendation is to have the students equipped with the same set of the colored pens as the teacher. So, they do not have the problems of finding the right color to copy the elements of the map. Sometimes, especially to younger students, choosing the color causes problems and slows the work.

The teacher should be open to any students` suggestions, but careful about choosing the proper association that will suit the whole class as well as the topic. Every unknown word should be written down along with the correlated drawing (if it is presented that way), so there is no doubt about its pronunciation and meaning.

The main directions for using Mind Maps as a teaching tool in the most effective way, depend on the age of the students and on the effects that are planned to be achieved.

III. EXAMPLES OF MIND-MAP USE

This paper will present some of the Mind Maps we used in different situations from presenting pre-school lessons, through elementary and high school and the university level learning to informal education for an ECDL (European Computer Driving Licence) exam.

In each situation, the students had not been previously acquainted with mind-maps and that was the first time the mind-maps were presented to them.

A) Preschool

Fig. 1 shows the map that was constructed with preschool children. The topic (Water) was partly familiar, but also contained some new terms. The children readily accepted the process of drawing and creating the Mind Map.

The map had four branches that presented where water could be found, how it could be used, what are its main properties and what are its states. The central image also presented the chemical formula of water.

On the map, there are 20 terms presented with text or drawings. Still, it looks rather simple, the children liked it and joyfully contributed to its construction.

The branches were enriched with numerous children's drawings that showed their ideas and knowledge about the `water in nature ` and `water in everyday life`.

B) Elementary school

Fig. 2 shows a map similar to (translated from) the one that was developed during chemistry classes in elementary school. It comprises about 10 lessons and is gradually developed during two months. During each class, the branches grew gradually.

The topic is Atom, and the map consists of definition of the atom and the elements, explains the structure of an atom and shows the main structure of the periodic table.

Figure 1: Mind Map – Water

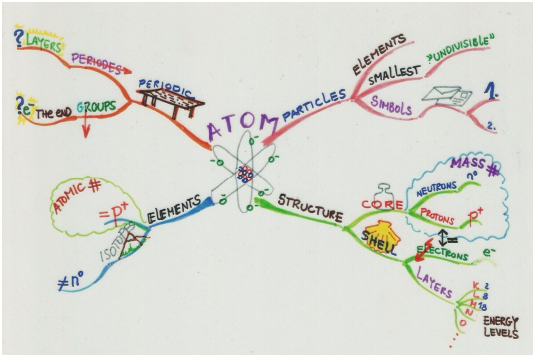

Figure 2: Mind Map - Atom

With its 4 main branches, the structure of the map develops - consisting of 42 terms and facts at the end of the learning period.

The students gladly accepted the method of Mind Mapping on the first encounter with it. They contributed to a map construction with their ideas and associations. The atmosphere during the classes were relaxed, the students showed longer-lasting memory, greater knowledge and greater self-confidence [7, 9].

C) University level

The map showed in Fig. 3 is made by a postgraduate chemistry student.

The structure of the map (topic: Sampling) is highly developed. It consists of 7 main branches and has more than 80 facts and explanations in text, drawings, symbols and graphs.

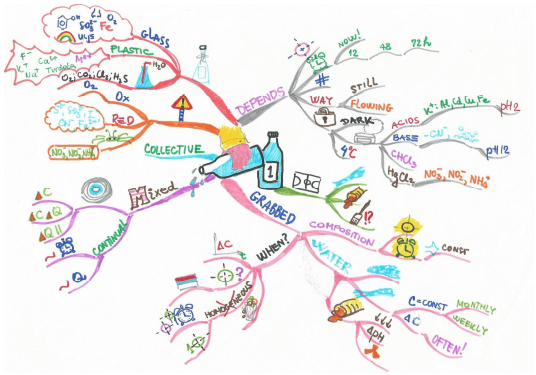

Figure 3: Mind Map - Sampling

during the preparation for the exam, as well as for recalling information during the test and oral presentation and expert talk.

D) Informal education

Fig. 4 shows a map constructed for the students' preparation for one ECDL-module test. The test consists of questions that cover the basic knowledge and facts about ICT (information-communication technology). The whole map consists of all the facts that are needed for answering the test questions.

The map was created for the preparation of the persons that are not very familiar to the field that is presented.

Although at the first glance the map looks very complicated, the students find it very useful. The numerous facts are systematically grouped and connected and it really helped to distinguish different elements of the matter.

This type of Mind Map is intended mainly for the classification and overviewing of the test requirement.

The map mainly consists of words, because there are many new terms that need to be introduced. This map has over 160 terms that are classified and properly connected and are all written on the one sheet of paper. Thus, a quick, simple one-page review is at hand.

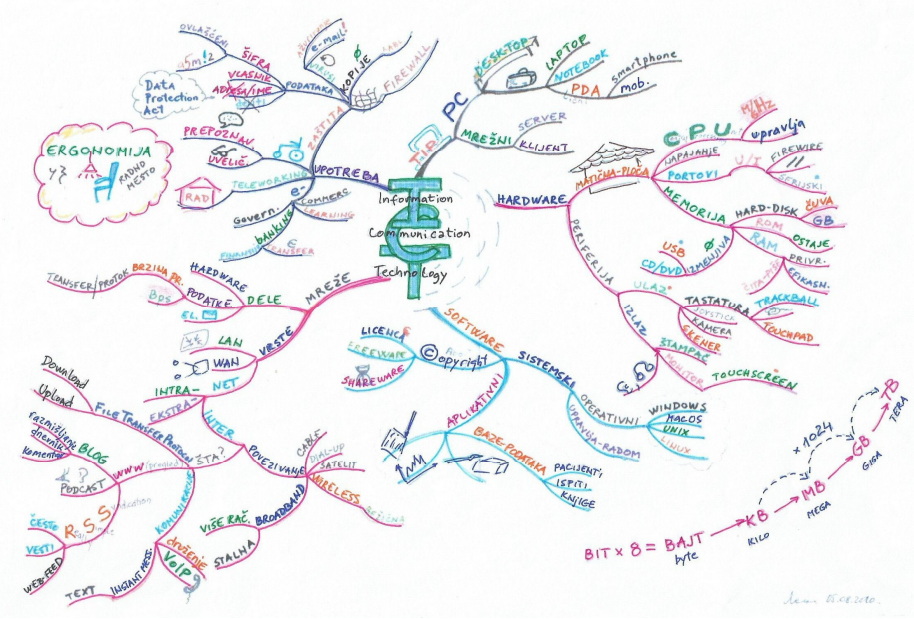

Figure 4: Mind Map – Information Communication Technology

The map was the basic tool for note-taking, memorizing and learning for an exam. According to the student's experience, the map helped a lot

IV. CONCLUSION

Our experiences show [7, 8, 9] that creative thinking is developed by using the Mind Map. Free thinking, associations that arise, more effective integration of the new information in the already present knowledge, lead to significantly greater effects of teaching and learning.

During our years-long experience in Mind Mapping, we found it very useful in every level of education. The use of Mind Maps left more time for practicing and talking, because of the effective memorizing and easier understanding of the relations and connections between the terms.

There was relaxed atmosphere during classes and enjoyment in drawing Mind Maps, there were opportunities for involvement for all the students.

The easily seen effects of using the Mind Maps brought out self-confidence in the students, which gave them greater interest for the matter that was to be learned. Including Mind Maps as a teaching tool in everyday work brings the positive effects. The effort teacher and students put in, bring much more benefits than standard teaching/learning techniques.

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Application of Matlab Redefined and Modified Applications to Solve Problems of Interaction of Chemical Elements and Their Impact on the Environment

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Abstract - This paper presents package of tools that provide adequate information and data on the interactions of certain chemical elements and compounds (reagents) and their technical - technological impact on both an experimental and industrial process. These applications allow appropriate tabular and graphical representation of certain kinetic models, which are in function and application in the educational process in the form of analytical and experimental research in subjects like chemistry and environmental protection.

I. INTRODUCTION

This paper is about a process called - Froth flotation for selectively separating hydrophobic materials from hydrophilic. This is used in mineral processing, paper recycling and waste-water treatment industries. Historically this was first used in the mining industry, where it was one of the great enabling technologies of the 20th century. It has been described as "the single most important operation used for the recovery and upgrading of sulfide ores". The development of froth flotation has improved the recovery of valuable minerals, such as copper- and lead-bearing minerals. Along with mechanized mining, it has allowed the economic recovery of valuable metals from much lower grade ore than previously. Froth flotation is a process for separating minerals from gangue by taking advantage of differences in their hydrophobicity. Hydrophobicity differences between valuable minerals and waste gangue are increased using surfactants and wetting agents. The selective separation of the minerals makes processing complex (that is, mixed) ores economically feasible. The flotation process is used for the separation of a large range of sulfides, carbonates and oxides prior to further refinement.

II. DEVELOPING A SYSTEM OF THINKING

In the existing equations for flotation kinetic the assumption is such that velocity coefficient for any sulphide minerals is the constant k. The number of investigators, as A. Gupta, D.S. Juan had calculated the of group models cumulative flotation from first order considering the following models:

- Classical kinetic model, $I=I_o[1-e^{-kt}]$
- Klimpel kinetic model, $I=I_o[1-\frac{1}{kt}(1-e^{-kt})]$
- Kelsal kinetic model, $I = (i_o-\phi)(1-e^{-kft})+ (1-e^{-kst})$
- Modified Kelsal kinetic model – Gama model from Loveday, Innou, $I=I_o(1-(\frac{k}{k+t})^P)$

The mentioned kinetic models are appropriate for presentation the flotation kinetic, very important for everyone project solution or assumption for good and sure flotation performance. According to the previous kinetic investigations for kinetic flotation (Classical kinetic model) for different sulphide, minerals for copper mineral will have the following equation (chalcopyrite):

$$I = Io\ [1-\varepsilon-\kappa\tau] = 89.25\ [1 \square \varepsilon - 1.025\xi\tau] \qquad (1)$$

According to previous kinetic investigations for kinetic flotation (Classical kinetic model) for different oxide – sulphide minerals constant k for copper mineral will have the following equation (65% chalcopyrite and 35% oxide minerals as cuprite, azurite, and malachite):

$$I = Io\ [1-\varepsilon-\kappa\tau] = 73.5\ [1 \square \varepsilon - 0.56\xi\tau] \qquad (2)$$

According to the existing kinetic investigations for kinetic flotation (Classical kinetic model) for different oxide – sulphide minerals constant k for copper mineral will have the following equation (65% chalcopyrite and 35% oxide minerals as cuprite, azurite, malachite), but with application of process of sulphidization with Na2S, (NH4)2SO4, NH2SO4 :

$$I = Io\,[1-\varepsilon-\kappa\tau] = 74.2\,[1 \square\ \varepsilon - 0.61\xi\tau] \qquad (3)$$

III. KINETIC FLOTATION MODELING OF CHALCOPYRITE USING SOFTWARE TOOLS

The software package for kinetic flotation modeling in MATLAB®(R) GUI, was enabling appropriate tabular or graphic presentation for Classical kinetic model (I. Brezani, F. Zelenek), determining the constant k in the function of the time frequency of the useful reagent addition.

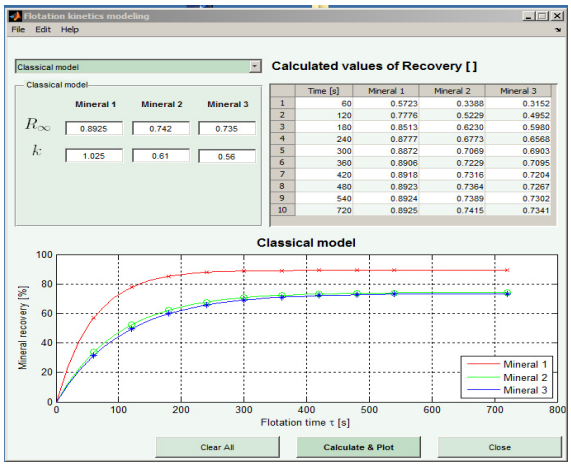


Figure 1. Kinetic presentation by Matlab – Classical model

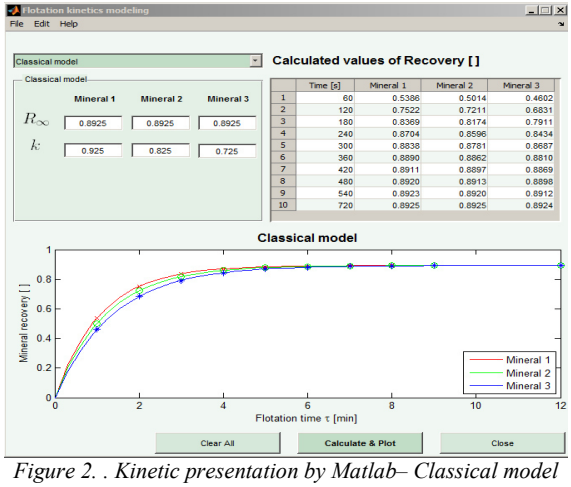


Figure 2. . Kinetic presentation by Matlab– Classical model

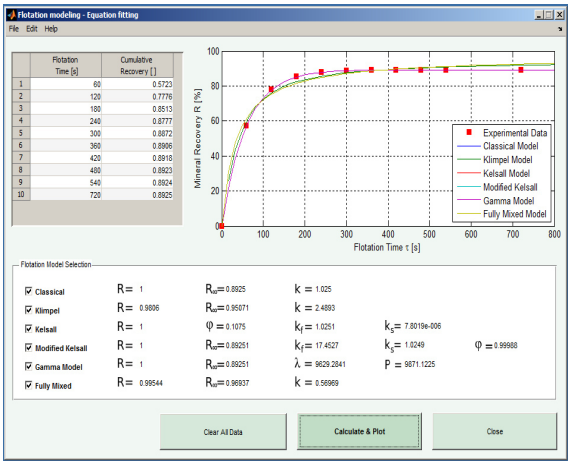
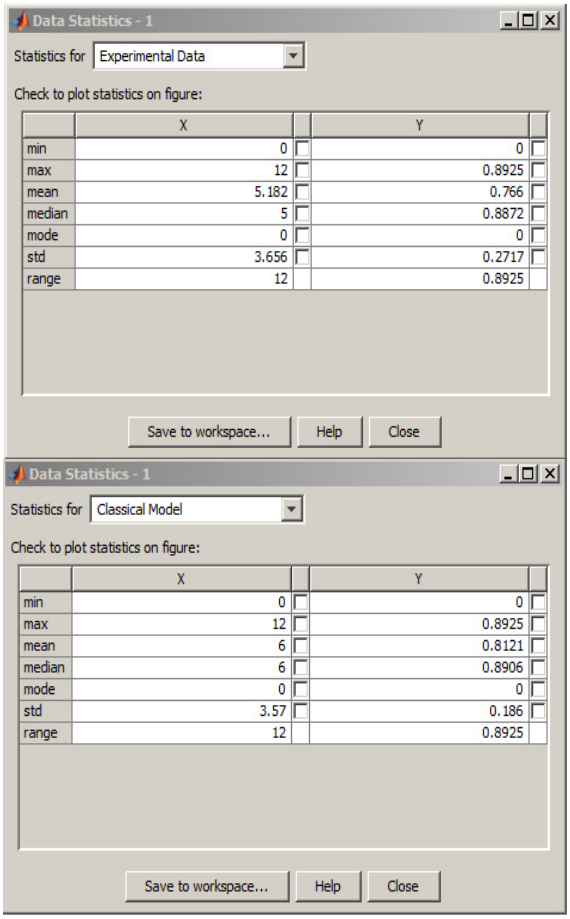


Figure 3. Kinetic presentation by Matlab



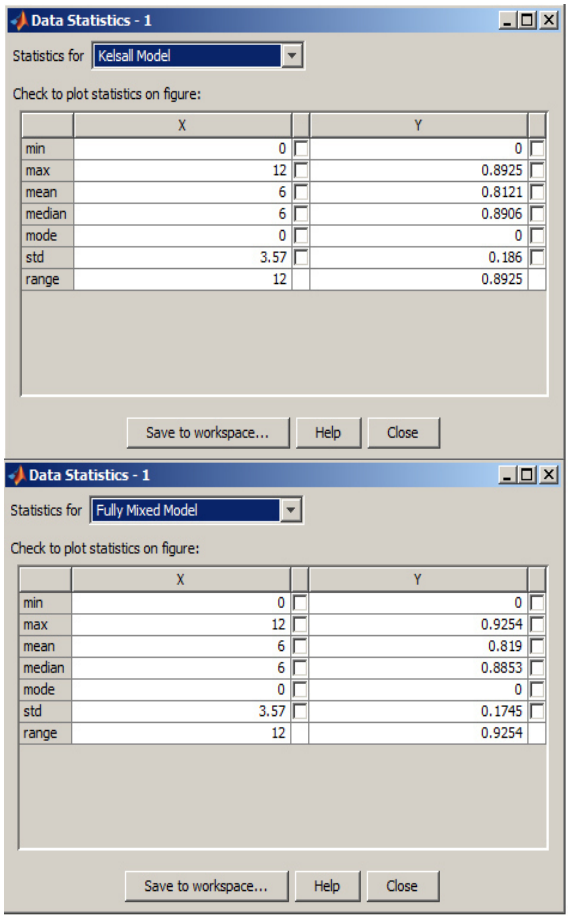


Figure 4. Results in total – comparison for all models

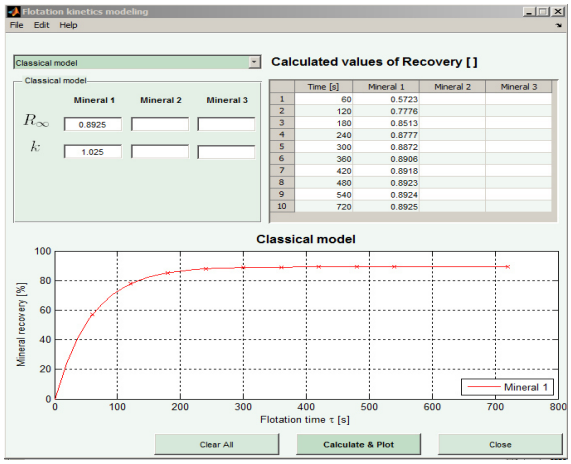


Figure 5. Kinetic presentation by Matlab

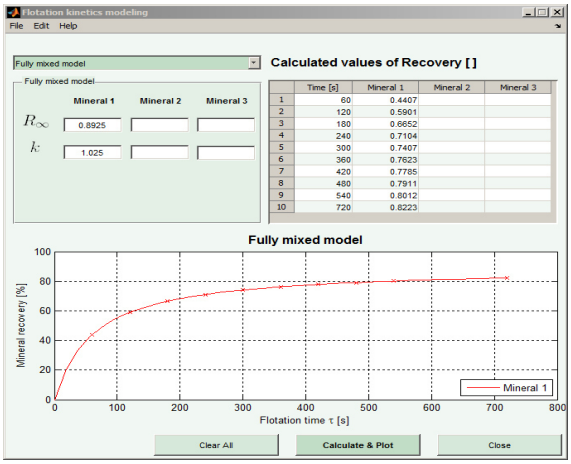


Figure 6. Kinetic presentation by Matlab

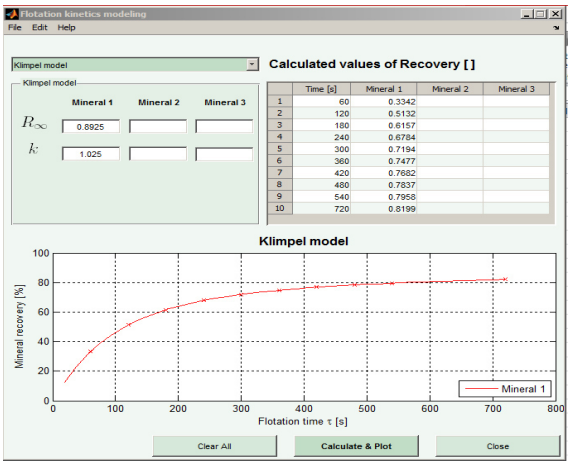


Figure 7. Kinetic presentation by Matlab

IV. CONCLUSION

The impact of using this type of applications leads to predictive analyzing some industrial processes that have some type of environmental impact on the environment. By using this type of resource is underpinned determining the desired or required results before they are put into use in industrial processes. The process of flotating can cause a type of environmental impact to the environment and therefore recommended the use of software tools that give insight to a small part of the process which is crucial both for the industry and for the environment as protection process one environment.

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Influence of Internet on Tourism Industry

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Abstract - Managing business achievement pivots upon an association's capacity to comprehend and profit by customer conduct patterns. The appropriation of the Internet has achieved a level of immersion and some conventional channels, for example, online travel agencies (OTAs) keep on dominating travel arranging. While conventional method for Internet use for travel arranging appears to be broad over all client fragments, higher-request Internet utilizes (i.e., online networking) are presently pervasive among some sections, especially among more youthful travellers. Continuous improvements in information technology (IT), especially regarding the Internet, have prompted changes in the way tourism-related information is disseminated. These progressions have influenced the arranging and utilization examples of travellers before and during their trips.

I. INTRODUCTION

Information technology (IT) has significantly changed travel and tourism [1,2]. From the advancement of Computer Reservation Systems (CRSs) in the 1960s to the Global Distribution Systems (GDSs) in the 1980s and the coming of the Internet in mid 1990s, the tourism business has dependably been faced with the ascent of new technological improvements that postured both open doors and difficulties [3]. As the Internet comes to its twentieth year of commercialization, IT keeps on advancing and effect the way travelers access and utilize travel-related information. In the first place, the Internet is currently involved a tremendous measure of information which basically speaks to the "outside memory" for some individuals, and accordingly, people have now turned out to be progressively dependent upon it for regular life [4].

Therefore, instruments, for example, web search tools have turned into a prevailing power that impact travelers' entrance to tourism items [5]. Second, the colossal development of online networking has changed the progression of online exchanges [6,7]. Third, late advancements in versatile processing, especially with the appropriation of cell phones and their applications for travel, makes new regions for information hunt and utilize whereby the relevantly characterized necessities of on-the go travelers turn out to be progressively unmistakable in managing travel choices [8]. Seeing how IT sways customer conduct can serve as a basic establishment for organizations to distinguish and create successful and manageable promoting correspondence techniques. Innovations go back and forth and, along these lines, it is critical for organizations to distinguish those advances with the possibility to fill their long-haul key needs.

Pre-trip travel arranging, which is a particular sort (and stage) of customer information hunt, can be viewed as a crucial segment of the trek involvement in that a traveler frequently needs to get a significant measure of information keeping in mind the end goal to build up a travel arrangement. Thusly, information accessible to individual travelers has critical effect on different parts of the traveler's basic leadership, particularly while picking a destination to visit [9-13] further, travel arranging helps the traveler settle on choices and manufacture desires for the up and coming excursion [14]. Subsequently, it is contended that travel arranging serves as a window through which it is conceivable to see how IT has changed travel and tourism.

II. INTERNET USAGE IN TOURISM

Tourism can be portrayed as immaterial, experiential, and perishable. Customary advertising, appropriation and, thusly, client administrations identified with the item depended upon the alleged "middle people" (e.g., visit administrators and travel offices), different offices, for example, destination showcasing associations (DMOs) and in addition media channels to interface and connect with travelers. In that capacity, item circulation and client administrations were restricted in their degree and scope in the pre-Internet time.

Since its commercialization in 1993 the Internet has saturated all features of life which has prompted in a constant disintermediation and re-intermediation of the appropriation of the item and,

thus, changing the fundamental structure of tourism industry. When all is said in done, the Internet can be seen as a stage that encourages consistent mechanical advancements, cultivates new business practices, and changes the focused scene of numerous industry parts.

Recently, the Internet has moved from a representational platform built upon the HyperText Markup Language (HTML) to the so-called Web 2.0 that supports rich interactivity and content co-production with tools such as RSS, Ajax, JavaScripts, and Adobe Flex. The development of the Internet has enabled the conception of a huge number of new business models. For example, Amazon.com started as an online-bookstore in 1995 but has grown to become one of the top online retailers with over 615 million users (in 2008), generating more than $60 billion in revenue (in 2012). Since the mid-1990s, businesses in the travel and hospitality sector have actively adopted the Internet as a new distribution channel as well as marketing medium.

The adoption of the Internet provided the basis for the development of new systems linking consumers and CRSs/GDSs, which considerably lowered the entry barriers to new players. Thus in the late 1990s a series of online travel agencies such as Expedia, PreviewTravel, Priceline, and TravelBids began to provide direct access to the travel market. These new intermediaries provided new benefits for both consumers and suppliers because they further reduced transaction costs, increased volume discounts for consumers, and eliminated the coordination mechanisms from other sales channels.

Importantly, these innovations have been widely adopted by consumers. For example, as of July 2013 Expedia claimed to have about 12.4 million unique monthly visitors (see http://www.advertising.expedia.com), while Kayak.com averaged 10.51 million unique monthly visitors in the US further, Trip Advisor claims to have 57 million e-mailable global users and on average nearly 2800 new topics are posted every day to the TripAdvisor forums.

Travelers' usage of the Internet gives awesome chances to organizations to offer different sorts of administrations. Amid this first decade of the Internet (generally from 1991 to 2002) the travel and tourism industry got to be one of the pioneers in the utilization of the Internet as they conveyed adequately with their current and potential clients through online channels. About each tourism association had built up a site by the mid 2000s, and numerous had experienced the advancement from a basic "electronic pamphlet" to exceedingly intelligent frameworks that bolster reservations, look, and virtual visits; critically, the site had turned into the essential (and much of the time, the main) wellspring of contact with potential guests. All things considered, this change is effortlessly comprehended as the utilization of PCs as of now existed inside the area (i.e. the different worldwide dispersion frameworks (GDSs) connecting travel organizations to the carriers).

Additionally during this time, numerous inventive Destination Advertising Organizations (DMOs) started to understand their new part as accomplices inside the tourism framework wherein they got to be "information agents" as they tried to create and arrange a scope of new frameworks that would be utilized by their partners to share pertinent information. Strangely, the second decade (2001–present) was a period of much more noteworthy change for tourism showcasing where the center of technology rose up out of site functionalities and ease of use to one of influence and client strengthening, and all the more as of late to universality through portable frameworks. That is, while a large number of the center business changes were acknowledged in the main decade, the ascent of Web 2.0 made another round of adjustment, which required another transformational system for tourism promoting administrations.

Maybe the most essential component of this decade is the advancement of new "social" frameworks including apparatuses, for example, for example, charge aggregators, new sorts of virtual groups, and buyer survey destinations. For instance, Tripadvisor.com, set up in 2000, built up a plan of action that develops a drew in client base by helping them assemble information, read and post audits of travel items and attractions, and partake in intuitive travel discussions (O'Connor, 2008). In the later part of the decade, the presentation of cell phones, i.e., versatile processing frameworks that consolidate an assortment of advancements including correspondences, GPS, photography and the Internet, further improved the social environment such that it engages clients to control their travel experience at whatever time anyplace. These advancements give the setting to comprehension travel arranging utilizing the Internet as an essential establishment for maintainable administrations in the travel and tourism area.

III. ONLINE SOURCES OF TOURISM INFORMATION

A hefty portion of the current studies connected with tourism information sources have a tendency

to be constrained while they lead research utilizing one and only kind of online tourism information source. There is little research on ordering an assortment of online tourism information sources and after that looking at and breaking down the qualities of those sources. Author of [15] dissected the utilization of tourism information sites and characterized the typology of sites into entrance destinations, travel office sites, online group locales, open organization locales, and others. Authors of [16] recommended a sort of tourism-related site in light of the information conveyed between various clients in the tourism field. Contingent upon the information stream, they partitioned tourism-related sites into two gatherings: travel sites and tourism sites. Authors of [17] isolated tourism information sources into gatherings characterized as social sites, individual sites, promoting (corporate) sites, and article sites (Fig. 1)

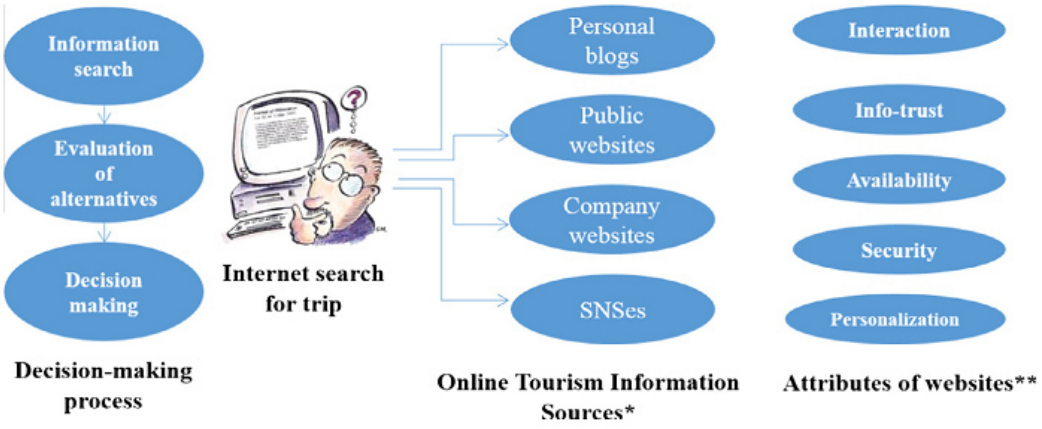

Figure 1. A conceptual model of the research

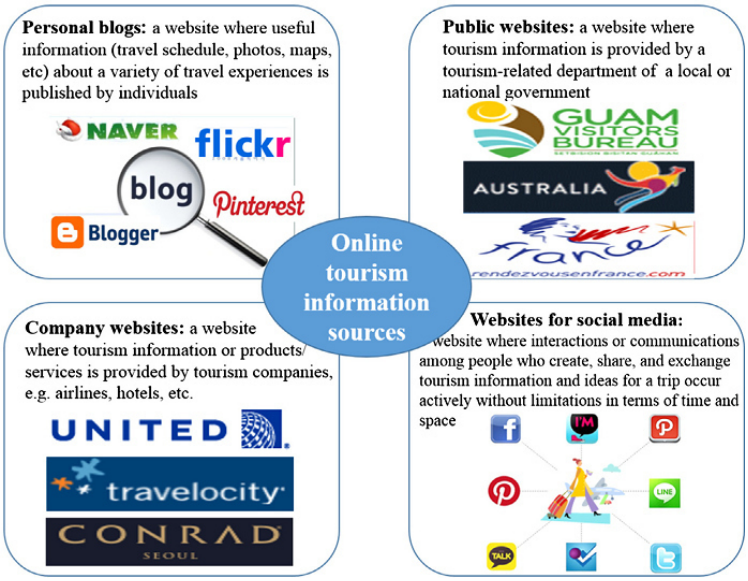

Figure 2. Types of online tourism information sources

Previous research suggests that online tourism information sources should be classified into the following four types:

- Personal or travel blogs and Internet cafes containing reviews of items of interest such as travel itineraries, accommodations, and restaurants.
- Tourism-related public agency websites such as the Korea Tourism Organization, local governments, and the Destination Marketing Organization (DMO).
- Tourism-related business or company websites such as travel agencies, airlines, and hotels.

- Social media websites such as Twitter (Fig. 2).

A. Personal blogs

Web journals are sites that give different substance regularly distributed by people or a gathering [18]. Weblogs or online journals can be described as diaries on the web where the substance is orchestrated in turned around sequential request [19]. A web journal is one of the guideline stages for the general population in imparting information in agreement to their own particular advantages [20]. A site may contain different sorts of information and be used for an assortment of purposes. For instance, a few bloggers utilize a web journal as an online journal included their day by day life, suppositions, and self-reflection. Different bloggers distribute an expert news coverage liable to be too altered, as daily paper or magazine content [21]. In this study, an individual web journal is characterized as a site where helpful information (travel plans, photographs, maps, and so forth.) around an assortment of travel encounters is distributed by people.

Websites have as of late demonstrated their business sector potential in the tourism business, and travel ads on well known web journal locales have step by step expanded accordingly. Moreover, online journals are a critical instrument to distinguish the necessities or interests of travelers. In light of this pattern, author of [22] subjectively broke down the sentiments posted in driving travel online journals to pick up a comprehension of their relationship to a particular tourism destination. This investigation was done utilizing the semantic system examination and substance investigation techniques. The outcomes uncovered the qualities, shortcomings, and the focused environment of Charleston as a traveler destination. While attractions, for example, memorable locales and the coastline were observed to be the primary qualities of the destination, significant shortcomings incorporated the climate, framework, and eateries. The outcomes additionally demonstrated that the most as often as possible utilized watchwords exhibited that travelers were communicating a wide range of parts of their travel encounters in their travel web journals. These included attractions, facilities, eating choices, and transportation. From a showcasing point of view, the outcomes uncover that a travel web journal is a valuable and a sparing approach to assemble client sentiments. The advancement of information technology and the developing number of travel online journals permit destination advertisers to screen their administration quality in a financially savvy way and upgrade travel encounters.

Authors of [23] investigated the level of consideration and worry that customers appeared toward travel bloggers. They would have liked to utilize an association hypothesis to comprehend the relationship between buyer inclusion levels, the promoting impacts of online journal messages, and shopper buy aims toward travel items. The outcomes demonstrated the agreed effect of the commercial impact. It additionally uncovered that these commercial impacts specifically affected buy aim. It additionally demonstrated that the more noteworthy degree to which travel bloggers got to be included in their excursions, the more they framed great impressions with respect to the notices on travel web journals. This study brought up that travel web journals are a positive approach to convey promotion messages. Brand demeanor decisively affects the impact of promoting on buy aim, thus mark administration assumes an essential part in advertising.

B. Public websites

An open site is a site made by a nearby, state, or national association [24]. Tourism-related open sites incorporate the locales gave by the National Tourism Organization (NTO) and the DMO. While their methodology and structures shift, tourism-related open sites are proposed to educate sightseers or bolster tourism to expand the quantity of guests. For instance, the KTO site (www.visitkorea.or.kr) gives information on where to go, where to stay, and what to eat in Korea. This information is given in the dialect of every nation on the planet, for local people and additionally nonnatives. In this study, an open site is characterized as a site where tourism information is given by a tourism-related office or association of a neighborhood or national government. In exploration concentrated on tourism-related open sites, [25] utilized the technology acknowledgment model to research the helpfulness of the DMO site and its impact on the expectation to travel to the destination. This study proposed a site helpfulness demonstrate that considered particular site highlights and the effect on the goal to travel. Site components, for example, simplicity of route (simplicity of getting to the information the client needs), content (an element of content and visuals), availability (load times for site elements and site pages), and buyer qualities (counting Internet use, online trek arranging encounters, and past visits to a destination or its site) were utilized as illustrative variables as a part of the model. The outcomes demonstrated that substance components (trip information usefulness and inspiration visuals)

were the most huge indicators of site value, while route and openness were the slightest huge. The outcomes additionally demonstrated that site value was a critical driver of purpose to visit a destination, while past encounters at a destination or its site negatively affected goal to travel. Authors of [26] explored site fulfillment by utilizing NTO sites. Information quality and framework quality were utilized as autonomous variables to inspect shopper fulfillment concerning the sites. The discoveries showed that, to start with, the information clients search for is for the most part connected with neighborhood maps, transportation, and convenience. This information is vital for arranging an excursion. Second, information quality is connected more to site fulfillment than framework quality, and site fulfillment impacts goal to reuse or prescribe the site to different clients [27]. Notwithstanding, site fulfillment does not influence the expectation to visit a nation.

C. *Company websites*

An organization site is an informational site worked by a business or other private undertaking to offer particular information managing a business, association, or administration [28]. Tourism-related organizations, for example, carriers, auto rental organizations, voyage lines, lodgings, railroad organizations, and travel offices give tourism-related administrations to the general population. On their sites, it is conceivable to buy tourism items and administrations through an online installment framework. It is additionally conceivable to get travel information identified with that specific business zone. In this study, an organization site is characterized as a site in which tourism information or items and administrations are given by tourism organizations, including carriers, auto rental organizations, journey lines, lodgings, railroad organizations, and travel offices.

Authors of [29] examined the sites of New Zealand visit administrators to decide their advancement status. They checked on 50 visit administrator sites in the nation. The primary reason for these sites was to give logistical information and information. In the initial segment of their study, three gatherings of respondents (tourism academicians, tourism industry experts, and travelers) positioned the significance of 59 visit administrator site attributes. The specialists got comparative reactions from each of the three classes of respondents. 11 of the main 15 elements were viewed as essential. The 11 highlights incorporated the cost of items and administrations, online reservation and requesting, travel timetables and organizers, maps, and transport information. In the second a portion of their study, the authors computed the desire score for the 59 highlights. The desire score spoke to the significance of every site highlight.

The most astounding five desire means were messages, the cost of items and administrations, online reservations, checking accessibility, and items and administrations. Authors of [30] led a study evaluating the significance of lodging site measurements and traits. They thought about people who essentially searched inn sites for information with people who really made buys as online bookings. Extricated from past exploration, they could assess sites on five unmistakable measurements – reservation information, offices information, contact information, encompassing territory information, and site administration.

The outcomes demonstrated that reservation information was seen as the most essential element among the five measurements. The outcomes additionally demonstrated that both online buyers and online programs saw room rates as the most essential trait of the reservation information. Be that as it may, online buyers considered distinctive properties, for example, the capacity to check rates and accessibility and also to make online and/or continuous reservations as more imperative than online programs.

D. *Social media websites*

Online networking or informal communication administrations (SNSes) are electronic administrations that connection clients around the world inside a solitary framework. There are an assortment of approaches to show the qualities and terminology of these association connections [31]. Specifically, online networking alludes to the techniques by which collaborations and correspondence happens among individuals who make, share, and trade information and thoughts. This information incorporates interests, encounters, exercises, assessments, or genuine associations. Late research recommends that because of the improvement of telecom technology and the spread of cell phones, the utilization of SNSs is quickly expanding around the world. The reasons and effect of online networking are different. Individuals are sharing relationship-based information, and this information can serve as another instrument inside online networking destinations. For example, travelers publically post information on destinations, and they likewise scrap and share travel-related information gave by others [32].

In this study, online networking sites are characterized as locales in which collaborations or

correspondence occur among individuals who make, share, and trade tourism information, for example, trip thoughts. This information could incorporate ongoing climate or movement, travel action encounters, and conclusions on vacation destinations or destinations. Also, the information on the online networking is on realtime, and it is available at whatever time in wherever. Because of the late improvement of telecom technology and dispersal of cell phones, an impressive number of online travelers have started utilizing online networking sites. These sites differ from shopper produced content (CGC) interpersonal organizations like Facebook and Twitter to media sharing destinations like YouTube to customer audit locales like Consumers Reports [33]. Authors of [34] characterize online networking as a gathering of Internet-construct applications that work in light of the ideological and innovative establishments of Web 2.0, which permits the creation and trade of client produced content.

A significant number of these sites help customers in posting and imparting their travel-related insights, remarks, and individual encounters, which serve as information for others [35], they examined online networking showing up in web index results with regards to travel-related quests. Utilizing an arrangement of predefined, top level, travel-related watchwords, including settlement, inn, exercises, eatery, and shopping) in mix with nine U.S. vacationer destination names, this study distinguished key qualities of a traveler's utilization of an internet searcher for travel arranging. The investigation results showed that among the aggregate list items, online networking constituted a generous part, recommending that web indexes direct travelers to online networking locales. The examination comes about additionally gave a breakdown of the sorts of online networking and the relationship between online networking and hunt inquiries. For instance, virtual group locales were very connected with the watchwords tourism, exercises, attractions, facilities, and inn. Destinations for person to person communication, photograph/video sharing, and online journals were firmly gathered together, and they were identified with catchphrases, for example, occasions, nightlife, and park.

IV. CONCLUSION

As organizations keep on deriving approaches to manage engagement with buyers in the developing Internet-based development zones, extra inquiries will without a doubt be figured. It is reasonable to note that each of current development segments in the online enclosure empower open doors for firms to better serve their clients. For instance, the dissemination of portable applications conveys comfort to travelers. In like manner, the headway of online networking content mining rehearses, i.e., the purported Big Data as another exploration worldview, brings an improved capacity of the firm to better comprehend their clients and subsequently serve them better with offerings custom-made to their requirements and needs in close continuous design. Thusly, from a vital perspective, adjusting to the mechanical environment requires a strong comprehension of the long haul patterns in the buyer market, as opposed to just the appropriation of an apparently "well known" technology that could get to be wiped out in a short term. As a rule, these are fascinating difficulties that, if oversaw appropriately, can yield higher administration principles and client mind that prompt supportable upper hands in the travel and tourism area.

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VALUE NETWORKS AND DUAL EDUCATION PROCESS

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Abstract - Recent learning research has demonstrated that interaction is a critical factor for learner satisfaction, higher level of achievement, higher learner engagement, and a positive attitude toward classical learning methods. The best environment for the interaction, in different areas of operation and the various organizations, are representing networks. Networking is built on the idea of how participants know should know and interact with each other. It gives organizations the power to share, making the environment more open and connected. Nowadays, networking has a vital influence on business and helps a lot in every field of life such as political field, economic field and educational field. The key question that arises is how to establish a value network that will enable the implementation of dual education concept.

Keywords: dual education, networking, skill development, simulation, value networks.

I. INTRODUCTION

Small businesses, especially ones that operate in developing countries, are facing the problem of insufficient resources, finances and capacities. Due to these limitations SMEs are often observed as unattractive kind of companies for employees who are experts in specific field. On the other hand SMEs need to employ wide range of people with specific knowledge and qualifications. So, there is a challenge for company to assist in the development of students, find ways to attract and keep student with required skills and knowledge.

Large organizations have formal organization structures with clearly defined roles and responsibilities for each employee. Also, their strategies and procedures are oriented to continual education and development of their employees especially those who work on key positions. They have enough resources to participate in the dual education.

When it comes to SMEs a situation is a quite different. Due to lack of hierarchy and work space systematization some employees do not have a clear view about their role in the organization. In most cases it means *"doing a little of everything"* which results in *"knowing a little of everything"*. This approach should have positive implications in the beginning when employees need to be informed with all company's processes and activities. In the later stage *"doing a little of everything"* slows down the process of specialization and increasing knowledge in some specific area. This applies particularly to the employees whose engagement is the key to succesfull business. The question is how to ensure the realization of the concept of dual education in a given environment?

Key employees in most cases have formal and informal educational background, significant experience from specific field and high expectations for their career progression [1]. Key employee is a *"person of trust"* and no matter on firm size, his or her presence is recommended and priceless for owner. He would be the most suitable for mentoring in the process of training students to practice, but he does not have the time or opportunity for that obligation.

Another problem that arises is the changing environment imposes changes in business conditions and affects the change of the stakeholders demands and has an impact on all phases of the production or services cycle. Any change in the organization causes a series of changes in the following activities and employees must understand and prepare for possible outcomes. In this environment, business can not be based on individuals but on teams. Therefore improvement of skills, education methodologies, tools and technics become inevitable. Many organizations perceive need for integration of advanced simulation technique in business process and education process. The reason we can find in limited ability to predict the result of series activities, behaviour of certain phenomenon, a variety of circumstances to explain a specific set of project outcomes and predict the characteristics of as-yet-unobserved phenomena…Nowadays simulation tools and software a simple to understand and easy to use and they can provide a significant advantage in 'What if?' analysis, heuristic path of measures, activity criticality and resource levelling. By creating a suitable model

we can see static and dynamic behaviour of entities in more realistic environments. Such an environment helps us in decision-making processes, defining the parameters of operation, but also for education of employees. They can actively participate in simulations and analyze the consequences of their work.

In developed countries, SMEs are considered to be the main engine of economic growth and dual education process, but in less developed countries they can also have significant socio-economic effects especially when it comes to employment.

II. SKILL DEVELOPMENT IN SMES: BARRIERS AND POSSIBILITIES

SMEs are facing with many problems, especially those that operate in developing countries. Lack of finance, resources, limitation in size and number of employees can cause many barriers to sustainable growth and development. Regardless these limitations SMEs represent a significant source of employment. The aim of this paper is to examine possibilities for student development in SMEs and to make recommedations for their work improvements. It is also of great importance to analyze how modern methods and techniques can help in the development of competence of students. The increasing demand for business networking and interdisciplinarity complicates the process of work and education.

Research done by Moraca et. al (2014) showed current state of the SMEs in Autonomous Province of Vojvodina, Republic of Serbia [2]. Overall number of the companies that participated in the research was 102. The main objective was to investigate segments and conditions of SMEs business activities and to provide suggestion for improving their business performances.

One element of the research was training issue where respondents using a Likert scale (from 1 to 5) to assess level of providing formal and informal training activities by company (Figure 1).

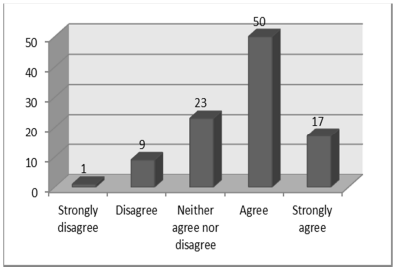

Figure 1. Employee's attitude towards organizations of trainings by company

Figure one indicates that majority of the respondents work at companies that organize some kind of trainings (67%). Almost 23% of respondents are indecisive when it comes to question about trainings. The main reason for such kind of answer should be lack of formal trainings in companies. SMEs are more oriented to on-job trainings than formal ones. Thus, sometimes employees are not sure about concept of training implemention because they can not make difference between on-job training and ongoing business activities.

About 10% of respondents agree that their companies don't organize any training activity for student. Students in those companies don't have any possibility to increase their knowledge and skills in specific field.

Lack of strategies and activities in the field of employee's education not necessary influence their attitude to quality of work life and work conditions in general.

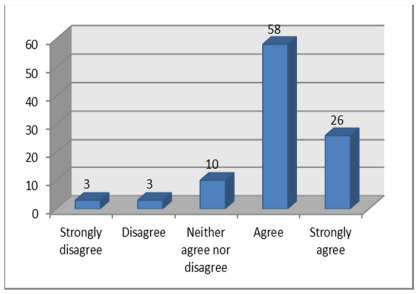

Figure 2. Employee's attitude towards work conditions in company

The majority of respondents agree that their companies provide good work conditions for them (almost 85%) no matter on fact that strategies for formal trainings and informal education do not exist.

Working on well-paid position without overtime work, in most cases, is enough for employee's satisfaction with company's work conditions. This fact describes lack of winless of employees to increase their knowledge and skills. On the other hand rests of respondents are not satisfied with current work conditions and in many cases those are people which presence is priceless for the company [3].

SMEs are specific category of enterprises, and skill development is facing with many challenges. Upgrading existing skills or acquiring new ones is a challenge for the owner or a general manager because of insufficient resources and low level of motivation of employees [4].

Employees represent a significant part of each company's strategy where special focus is put on their development, education and improving their work life quality. It is not rare that owners of SMEs take full credits for achieved success and company's development. Schlosser state that in many cases key employees are ones who have the most important role in achieving good business results. He defined key employees as most effective ones that they get job done and their work is has most contribution success of venture [1]. Results from previous section showed that it is not necessary to provide possibility for skill development for all employees but only for those who are progressive and proactive. Thus, in the following text we will observe and analyse only category of employees whose activities are significant for achieving good business results.

Key employees usually do not want to run own businesses. Stress management and responsibility are the main reasons why key employees are not ready to run their own businesses and become entrepreneurs. They are satisfied with their position as key employees but over time it is obviously that they will need some promotion and moving forward [1]. Financial reward, praises by owner are not enough for people who are high ambiguous.

Many authors agree that a highly skilled workforce is crucial for improvement of competitiveness and continual development.

Many SME's representatives think that regular formal trainings are not the best choice for employee's development. They are more willing to participate on informal kind of trainings (training on the job). In that way SMEs gain more benefits because of larger difference between cost and benefit [3].

The most present barriers in skill development at SMEs are awareness, finance, provision and access [3].

Employees that are involved in process of development skills are able to achieve better results in shorter time and with a less money.

Godfrey states that better educated workers are more flexible and oriented towards innovation, retraining and relocation [5]. All this can significantly influence the effect of dual education.

One more barrier is Government attitude for attending formal trainings in SMEs for students. Even in case that government defines strategies and acts for formal trainings, small business is seeking for educated employees. They do not want to train students. Scientific literature define this phenomena as a "purchasing a final products". Instead of invest in training programs to educate students or employees for some specific knowledge or expertise, small businesses hire talented individuals for full time or only for particular part of job.

SMEs owners are more interested in organization training on job and in the most cases that means new employees learn from older ones. As formal trainings are not so advantageous options for SMEs it is necessary to develop environment for their growth and development beyond internal capacities.

Simulation modelling can be one of the solutions that can solve the above problems. It is useful in cases where it is difficult, risky or too expensive to organize training for specific jobs. Participants can personalize the environment and adjusting the real conditions and situations. One example is the training of welders on blowtorch that simulates different types of welding. In SME environment, simulation, help to looking on problems as a whole and articulating the complete set of relationships, interactions, and uncertainties. It is applied in different fields of action and distinct projects [6]. …

Simulation methodologies have systematically applied systems thinking constructs to education process. This significantly helps in the analysis of important activities, processes and aspects involving requirements, cost, risk and time, especially the ones that are critical for work performance and success.

In the modern literature networking is presented as concept for improvement of business results, better internationalization and increasing tangible and intangible knowledge within the network. But the network will create favourable conditions for work and competence development of students and employees, only if it is established an enabling environment for co-creation. Only if established value network.

III. NETWORKING IN RESPECT TO SKILL IMPROVEMENT

According with research done by a major of North American bank (Anon), sustainable and fast-growing SMEs are part of formal and informal value networks. Existing of external relationships with stakeholders is an important strategy for small business development [7].

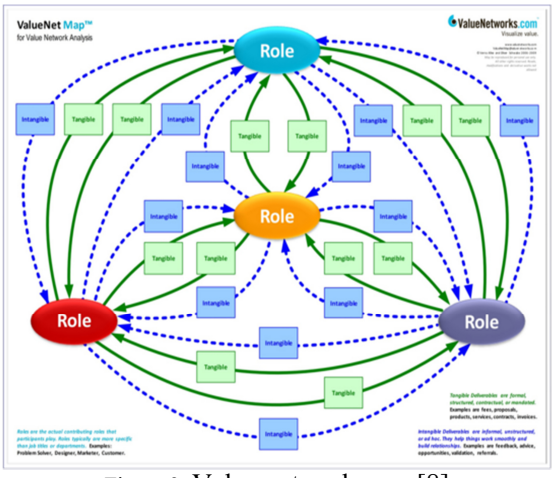

Figure 3. Value network map [8]

Allee defines value network as the group of nodes (people and their roles) and relations among them. Focus of this concept is put on flows of tangible (goods, services and/or revenue) and intangible value exchanges (knowledge and benefits) [8]. Value network is upgraded concept of value chains which is primarily oriented to traditional industry (e.g. manufactory) and tangible assets [9].

On the contrary, value network put focus on value creation in the process of sharing intangible knowledge. SMEs as part of value network gain a number of benefits [10]. As it is such a wide topic of discussion, we will focus mainly on the aspect of individual employee and his/her work life quality within the network.

The ideas of collective invention are convenient for describing the dynamics of knowledge diffusion through networks. Collective invention is characterized by high invention rates and fast knowledge accumulation created by disclosure of information between competing agents. It is driven by exchange and circulation of knowledge and information within networks formed by groups of socially connected individuals.

Networks that interconnect diverse actors promote both knowledge creation and dissemination [11]. Knowledge is created and disseminated within networks consisting of actors and relationships among them. Networks facilitate learning via the transfer of knowledge from one firm to another as a conduit for knowledge transfer. Networks also facilitate mutual learning and become the locus of collective invention [12]. The ability to learn about new opportunities requires participation in networks, thus a wide range of inter organizational linkages is critical to knowledge diffusion, learning, and technology development [13]. Relationships and networks are an important and strategic resource for firms [14]. Firms in a cooperative network can utilize their networks in a variety of ways in addition to the above merits. They not only share the costs and risks of their activities but also obtain access to new markets and technologies and make use of complementary skills [13].

The networks are instruments that might help firms to voluntarily expand their own competence by means of complementary partners beyond the limitations of their own organisation and of the localities where they are settled. In this context, the process of 'learning' offers a dynamic perspective on the nature of networking [15].

Networks remain fuzzy concepts when we consider their own interrelated relationships and their relationships with the factors and variables of the whole economy, such as institutional arrangements, trading efficiency, level of specialization and agglomeration, as well as their dynamic evolution. The current published literature has addressed many important aspects of clusters and networks, yet there is still a lack of robust frameworks to combine and explore these aspects together within one competitive market.

Value network have the possibility to develop their own specific mixture of competitive advantages which is created on the basis of locally-developed knowledge as a result of mutual relations, cultural heritage and local characteristics.

Kitching [16] stated that it was important for SMEs owners to enable employee learning rather than take an active role in training students or employees. Learning process provides better results when implemented within open system with large number of partners and resources [17]. Such kind of cooperation supports development of innovative business environment defined as Open innovation.

Within Open innovation employees from different companies should work together in order to develop new product and services or to improve existing ones. In that process focus put on intangible value where employees exchange and share knowledge which results in increased productivity and better work life quality [18].

IV. SIMULATION IN EDUCATION PROCES

If we analyse the existing methodologies, methods of modelling and simulation are mainly present in some aspects of the education methodologies in the field of IT. Application of the methods of modelling and simulation in

education methodologies related to any other business or scientific field is not significantly represented. This is particularly evident when we observe the small and medium-sized enterprises. The main idea behind our proposed approach aims to integrate various stages in education and business with design, modelling, simulation and physical implementations of business tasks. Existing methodologies facilitate and standardise some aspects of education and business, but there is a significant problem of their application in the sector of micro, small and medium-sized enterprises.

The suitability or appropriateness and relevance of simulation techniques is an important factor to consider in practical real-world applications, particularly as there is a growing need to address the complexities of modern processes and the difficulties of dealing with different layers of decision-making within a management structure. In most organizations, it is evident that changes at one level of management will have an impact on others [19]. Clearly, there are tools that could be used at each level, but better understanding will be needed of the relationship between the different process layers and phases and of the way to connect simulation tools that relate to each layer in order to deal with business activities as a whole. The purpose of modelling and simulation is to verify whether the design models meet the expected performance. Since the sub-processes of education and implementation are carried out through several iterations, the team has to enter or copy the same or similar data multiple times, which takes a very long time. It should be taken into account that any change in the activities may require a series of changes in the following activities and is of great importance to the understanding of possible outcomes.

Sometimes the development and testing of model is very expensive and takes considerable amount of time ... All of this focus us on the extensive use of simulation methods as an integral part of the education methodologies in order to increase the competitiveness by reducing the time of implementation, lowering the cost and therefore increasing the quality and results of operations.

V. CONCLUSION

Environmental turbulence refers to the amount of change and complexity in the environment of a company. In modern business we need to be aware of existing not only *market place* in traditional way. Networked environment provides more possibilities for increasing knowledge and experience. Thus, there is also *market space*. Therefore the most important learning events should take place in collaborative knowledge building modes. This interactive aspect includes real dialogue as well as integration of different forms of representation and different forms of learning activities (reading, writing, discussing, using metaphors, audio, visual). The design of on-line learning for workplace contexts then should incorporate and facilitate socially situated interactions resonant with those situations in which the employee are expected to learn to be effective.

Using simulation technologies in network environment, problems of insufficient resources and finances could be overcomed, more innovative and competitive goods and services could be developed and launched on the "educational market". Also, students and employees increase knowledge and develop their skills through continual cooperation and collaboration within network. Larger capacitates more interactions with partners from different areas and greater access to resources result in better opportunities for skill development which leads to increased quality of work life for employees.

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Instructional Design in an Online Environment

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Abstract - In this manuscript the authors describe the basics of the instructional design and the potential of the instructional design framework online learning environment, further, it highlights the possibilities of student motivation on MOOCs with planned activities. These activities help to motivated the students involved and thereby lower the drop-out ratelevel.

I. INTRODUCTION

The following basic concepts can be found in each instructional design model: student, teacher, educational content, organization of learning, methods, the process of teaching, feedback, evaluation and difference between students. These basics concepts and their relationships have been studied in the 100-120-year-history of education theory. Education design is a specific field of education theory. Conversely, instructional design looks back on approximately 40 years of history as a science. Educational design models are based on the following basic concepts: learning outcomes and educational goals, learning process, performance goals, education and learning events and evaluation of achievements. The essential questions of education theory and instructional design have not changed significantly even with the emergence and spread of the digital educational culture. With the development of knowledge about learning, these models have been somewhat modified, but are equally true in traditional and online learning environments.

Among the instructional design models, the first significant ADDIE model was released in 1975 (Analysis, Design, Development, Implementation, Evaluation) (Branson, 1975). The model focuses on the content development process and its general principles and general process of digital content development remain current even today. Shortly thereafter, in 1978, Walter Dick and Lou Carey created an instructional design model that applicable to development and education theory (Dick, W. - Carey, L. 1978). The general steps and elements of these models were the formulation of goals, analysis of the education, input characteristics, success criteria, measurement of success criteria, educational strategy, content development, formative evaluation, summative evaluation, revision and correction. After the emergence and advancement of cognitive psychology, education design also came to a new definition: "A systematic process that is employed to develop education and training programs in a consistent and reliable fashion" (Reiser & Dempsey, 2007). Nowadays digital content development is now a common and widespread technical solution. We pay more attention to the efficiency and effectiveness of development in digital and online learning. In 2016 the NEXIUS model appeared, which is a new educational design model, intended as an answer to new expectations (Ollé et al. 2016.). In this model, the following steps define the content development process: curricular synopsis, manuscript, student activity plan, scenario, development of electronic curriculum, correction.

II. INSTRUCTIONAL DESIGN IN AN ONLINE ENVIRONMENT

Developing an online course that is engaging, promotes interaction, motivates learners, and above all facilitates learning is easier said than done. It's even more challenging when trying to modify a face-to-face course for the online format (Morrison, D., 2013b).

In traditional education settings, classroom walls act as boundaries for instruction and learning. But online education has no walls and uses a delivery method that shifts the course development process entirely. This shift suggests instructional design principles and models are critical, are needed to address the complexities inherent to the web as a delivery mode. Following instructional design principles for online courses ensures the focus is on student learning and not on the technology or platform (Morrison, D., 2013b).

A primary criticism of MOOCs is that their completion rate is very low, approximately 10% (Wilkowski , Deutsch & Russel M., 2014). According to other authors (Jordan, 2014) the

majority of courses have been found to have completion rates of less than 10%.

Appropriate instructional design and MOOC developing, where the users' activities were planned, leads to lowering the level of the drop-out rate in the framework of online courses. According to Krippendorff (2006): design brings forth what would not come naturally and it is essential to provide each participant with the opportunity to gain practical, relevant knowledge about course design that can be applied to work or personal education projects. The ultimate goal of course design is to develop effective, sound courses that focus on learning, not teaching (Morrison, D., 2013a).

In terms of (online) learning, the students can be motivated with: 1. educational contents and 2. potentional activities. The activities can be planned according to instructional design principles. These activities are: learning using educational contents, such as: text, presentation and multimedia, forum activities and quizzes. The authors' principle is based on the following intentions: 1. there are limited possibilities for changing contents and structures after starting the online course 2. for learning and teaching purposes the authors mostly use educational videos 3. the aim is intensive communication, using more channels (messages in learning environment, e-mails, Facebook groups etc.) 4. contents and activities divided into obligatory and recommended groups 5. intensive communication with the teacher and in student groups, frequent feedback information.

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Increasing Motivation for Learning Mathematics Through Debate

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Abstract -The students' attitudes towards mathematics are not on high level. Usually, the students do not like mathematics very much and mathematics is not on a list of favorite subjects in the schools. Because of that, we are working on Erasmus+ project whose main goal is to approach the students with the beauty of mathematics. In the project MATHDebate - the Voice of Students - Searching Excellence in Math Education through Increasing the Motivation for Learning (2016-2018), where by using debate on mathematics problems and ICT methodology for learning, the students' mathematical skills and their abilities to solve practical problems will be enlarged. A project of this kind is an excellent opportunity for making arguments between minds, criticizing different opinions on some topic, all of it with one goal: achieving very good students' skills in mathematics.

I. INTRODUCTION

In today complex society, learning and understanding mathematics and natural sciences has become necessary for full development of everyone. The mathematics is not popular subject between the students. Most students do not like math because they usually do not get the desired results. This usually lead to the anxiety and even phobia for the mathematics. Generally, they face up with conquering the basic mathematical concepts, but also, they could not use the mathematical knowledge in other sciences and in various practical situations. Although mathematics is so important and it is on a pedestal between the sciences, among pupils it is perceived as a difficult, abstract, boring and no practical subject, [1]. These students' attitudes towards mathematics are one of the reasons for low success of the students on all education levels. In many researches, [2], [3], [4], it is shown that the fear of mathematics is a factor for low success in mathematics. Generally, the students' attitudes towards mathematics and their success in mathematics are in positive correlation. A contribution in the study of attitudes toward mathematics was by Neale, who underlined that, "attitude plays a crucial role in learning mathematics and positive attitude toward mathematics is thought to play a key role in causing students to learn mathematics" [5]. Neale in [5] defined mathematical attitude as "a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activity, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless". In [9] it is observed that the concept of attitude includes at least three verbs: to think, to feel, and to behave. Thus, students' attitudes toward mathematics affect how well or how often they do it, and how much enjoyment they derive from it, [8]. All teachers, especially teachers of math, have struggled to create authentic student interest in the concepts learned in class. Students often go through the motions of the class period because they are required to do so without any genuine interest. This must be changed by considering adding any of these four suggestions into the classroom: taking problems from their real lives, using a creative approach, use pop culture, or by making math music videos. Awarding of the students' attitudes towards mathematics would be useful for the teachers.

At the beginning of each semester, attitude test could be applied to the students, so that teachers can identify the students who have negative attitude toward mathematics and can take required precautions. In order to make student active, to increase their motivation, and attitudes, mathematics should be associated with everyday life. Using concrete materials in learning

environments positively increases students' mathematics achievement and their attitudes towards mathematics. When students are satisfied with the activities in the learning environment, learning would be more permanent and meaningful. Therefore, this situation is important for students to have positive attitude. The improvement in attitudes is likely to be more significant when taking into consideration different environments, but the main contribution is determined in the class environment. Research on this topic has shown that teacher support regarding autonomy affected student motivation, among other aspects, [6, 7]. To overcome these phenomena, it is necessary, to develop new methods by the teachers, activities in which the students will be active in the realization of the teaching process. The classical approach in the teaching, creates a passive student, so the students must be encouraged to take a part in analysis of the mathematical curriculum. By the NCTM, "*Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well."*

Students learn mathematics through the experiences that teachers provide.

- Teachers must know and understand deeply the mathematics they are teaching.
- There is no one "right way" to teach.
- Effective teaching requires deciding what aspects of a task to highlight, how to organize and orchestrate the work of students.
- Effective teaching requires continuing efforts to learn and improve. Teachers need to increase their knowledge about mathematics and pedagogy.

In the last period are realized many projects in which the main area of the research is the mathematical education. In that projects are elaborated many procedures for solving of some mathematical problems. There are many realized projects in order to increase the mathematical knowledge through solving math problems. But in none of the past projects there are not developed various methods of learning and teaching mathematics, and even more there is not developed an approach in which the student will actively participate in the teaching of mathematics in a way that alone will choose the method that would be delivered to the intended curriculum content.

II. MATHDEBATE - THE VOICE OF STUDENTS-SEARCHING EXCELLENCE IN MATH EDUCATION THROUGH INCREASING THE MOTIVATION FOR LEARNING

A. Description

Improving students' motivation to learn mathematics is crucial for many various reasons. At the EU level, the Education and Training 2020 strategy underlines the importance of providing efficient and equitable education of high quality in order to improve employability and allow Europe to retain a strong global position. To achieve this objective, continued attention must be paid to raising the level of basic skills such as literacy and numeracy (Council of the European Union, 2009).

In the last ten years all the schools in Macedonia and many other neighbor countries face with great difficulties to make students to like and learn Math. Although it is an essential subject for future career development of the students it is usually thought than Mathematics is very difficult, not interested and not connected with other subject area. The knowledge of the students is decreasing every year. This can be seen by PISA and TIMSS studies conducted in few schools in our country, and from low achievements on external examinations organized by State Examination center. When the students are in position to select their high school (after ninth grade), because of the fear of studying Mathematics they usually choose their vocation without any Mathematics in it, like low school, language schools, medical schools, arts, etc. The Technical and Science Universities are not popular and have lack of students. For example, there is none unemployed math teacher with very big percent of unemployment. The state Ministry of education made this question as a national priority and they made reforms to increase the level of Mathematics knowledge. Reducing the share of low-achieving students in mathematics is a priority in every European country, defined as one of the benchmarks for 2020. It also corresponds with one of the four strategic objectives for the European Council's framework: "Improving the quality and efficiency of education and training; acquiring key competences and making the level of education and training more attractive and efficient "(C119 of 28.5.2009). In efforts that the Ministry of education made to solve this problem, Mathematics was introduced as an obligatory subject for graduate students on the state graduate examinations. But this was not fulfilled because of strong negative debate by the students.

This motivated us to make project about new methodology and create innovative ways of

teaching and learning Mathematics using modern technologies, and this also satisfies the European priority to "support the professional development of teachers as mediators of creativity and innovation; promote the incorporation of creativity and innovation at all levels of education and training". We want the teachers together with the Universities professors and associations that work on these topics to share their experiences and thoughts and develop new methodology for learning math skills though democratic process of choosing teaching methodology. Using this method, they will learn more, they will be more motivated, they will use modern technologies to study, and big percent of the students will like to continue with their education in the field of science and technology area. The project is focused on student-centered and problem-based active learning, and fostering critical thinking skills. The target group will be the students aged 11-15, i.e. in the last three years of the elementary schools. We believe that the implementation of our project will increase the underachievement in the basic skills of math, science and literacy through this new effective and innovative teaching method and make excellence in mathematics education. The project will be able to make a comparison with the topics, matter, and types of problems that students in different countries have and share the experience and knowledge with Math teachers from the selected countries (Macedonia, Bulgaria, Romania, Cyprus).

B. The MATHDebate Method

The MATHDebate method we are going to introduce in the framework of this project is innovative in several ways:

- the method uses very attractive way of learning mathematics where the students choose by themselves methodology of adopting the knowledge;
- the method uses latest technologies very close related to the technologies students are familiar in their everyday life, and we mean on the application of e-learning platform and android platform. We are very aware that the e-learning platforms are becoming increasingly sophisticated and showing potential as an effective way of improving the learning process. All of this will be adjusted to the needs and abilities of the local schools which are partner organizations in the project.
- putting the students (and not teachers) in the center of the learning process is something that is not used in our country, and we believe that it will have positive consequences on student's interest on mathematics. That is why we have the target group 11-15 because we expect that in near future the students will start to choose mathematics or other related to be a major study field.

Since the Ministry of education of Macedonia noticed that mathematics is a weak link in the education system, there have been done efforts to change things and some projects are carry out in this direction. This carry out projects are focused on developing teachers' skills and abilities for effective teaching of the subject, and also include changes in the curricula. This project would be complementary with them in a direction of improving mathematics knowledge and skills of students, and focusing mostly at students and their way of understanding mathematics.

C. Results of the MATHDebate Project

The main expected result from this project after its completion is gaining students' positive attitude towards mathematics. The students should realize very early in their life that mathematics is important subject in their education. The motivation for learning mathematics is expected to be increased, and this will gain better achievements of the students not only in mathematics, but also in science and other areas.

We also expect gaining better competence of the teachers involved in this project, since they will look on the teaching process from the point view of the students and have better understanding for it. This is the way they are going to upgrade their teaching skills. Also, they will learn about latest trends of teaching used in the region and wider. The teachers will meet different educational system in different countries, they will be in position to compare them and as a result make the best possible approach for the students.

The e-platform as an outcome of this project is the most valuable. It will have no restriction for all the interested parties. After finishing the project, it can be used by students and teachers from other schools from Europe. This will be one of the European added value of this project.

At the end, we must mention that all the participants will gain better linguistic and communication skills. Throw the work on this project, meeting different people and collaborate with them, they will appreciate the differences and become more open and tolerant to the changes that should occur in the process of education.

III. OUTCOMES IN THE MATHDEBATE

A. Analysis of teaching methodology

The main goal of this output is to gather good practices of various teaching methods and their implementation in the schools that participate in the project:

- to make a survey of math teaching methodology and other activities involving math
- to specify the new technologies and the methodologies in use
- to collect the best practices in each school participant in the project.

Based on the received information and experiences a list of good practices will be provided. This list will be uploaded on the e-platform and it will be visible for all interested parties.

B. Developing of MATHDebate method and e-platform

This output will be an interactive e-platform as methodology for teaching mathematics for students between age 11-15.

Students will have opportunity to suggest new teaching methodology, based on their experience. This will be a unique chance for them to be a part of the process of learning math as a teacher. It will help them to have positive attitude towards Mathematics. There will be debates in real time between the pupils in each of partner schools, and between the pupils of the partner schools involved in this project.

Communication on the e-platform between the students besides math skills will also develop their literacy skills, ICT skills, critical thinking skills, cultural skills.

C. Guidelines and Guidebook of MATHDebate method

The guidelines and guidebook will include ideas for new teaching methodologies proposed by students. It will also help them to develop their competences for using ICT tools in a new and innovative manner.

As objectives of the Guidelines for students and teachers we expect that students would meet some goals like:

- mathematics becoming an interesting subject;
- discussions on mathematics as everyday routine;
- having greater curiosity and motive to learn mathematics;
- promoting journalistic articles on mathematics written by students;
- Development of training courses for teachers for using the MATHDebate method, as a new method for increasing the motivation for learning Mathematics;

Teachers are important part of this project. They should adopt their teaching to the new demands of everyday life, and to the demands of the students. Their key role is to help students to increase their level of knowledge in an interesting way. To achieve this goal, they should collaborate with the students on every possible level. Mathematics should be presented in modern way, with a connection to the real-life problems.

The benefit from this project should be wide, and not only for the teachers and schools of the involved partners. As the students starts to like Mathematics since they chose the methodology of teaching Mathematics will be part of their future life and career development.

IV. THE EXPECTED IMPACT OF THE PROJECT

The expected impact includes following aspects:

Impact on the participants:

- listening directly students' voices teachers will easily recognize which is the appropriate method for leading the lesson;
- promoting problem-based math learning;
- increasing usage of Communication and Technology - based methodologies for learning math and providing more attractive way for math education and for holding-up students' attention;
- Strengthening professional profiles of math teachers through improving competences in an innovative approach for teaching math with more effective teaching methods;
- increasing opportunities for professional development of math teachers;
- increasing level of promoting access to and learning through Open Educational Resources (OER);
- increasing motivation and satisfaction in teachers every day work;
- increasing capacity and professionalism to work at EU/international level, in international projects, etc.

- Impact on the participating organizations
- Participating organizations will be enabled to create and develop innovative approaches to addressing their target groups, by providing innovative approach to teaching math according to students' individual needs and expectations; use of ICT-based methodologies; increased access to and learning through Open Educational Resources; new and improved practices to look after the needs of disadvantaged group of students, especially those who have problems in acquiring the matter in Mathematics and need more than just classical lecture of math;
- By implementing the new skills and methodologies, participating schools directly change and modernize the teaching process. Being a part of large teams they will share their latest learned experiences and best practices with their colleagues and will help them to improve their own teaching methodology. The Universities will be preparing the future math teachers to be able to use modern approaches (skills and Math Debate methodology) in the future teaching process, which is very important for sustainability of the MATHDebate method.

The project has many impacts to target groups. Students as a main target group will achieve:

- increased knowledge of mathematics with teaching and learning through the innovative approach;
- opportunity to learn math in an interactive manner with effective methods and techniques of work;
- students will choose themselves the way in which the teaching process will be realized;
- students will be responsible for their own achievements;
- the level of motivation for learning math will be increased which will contribute in increasing students' knowledge;
- increased access to ICT, free software and open educational resources;
- increased access to the online platform with mathematical tasks, method which will facilitate the learning process;
- increased possibilities to communicate with other students from different countries or other participating country through the online platform or Online classes to get additional information and custom programs, tools etc.
- increased level of digital competence, especially regarding OER and online platform;
- more positive attitude about school education and the role of education in the future career;

Also, the other persons involved in educational process (parents, relatives) will:

- encouraging their children to use interactive methods for learning math, also including OER and online platforms;
- increased interest in career counseling at scientific European standards;
- increased access to information and tools to help them to assist the children to make adequate career decisions and career plans;

The school managers and decision makers will have:

- higher achievement in education;
- higher reputation.

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Application Cloud-Based Services in Technical Education

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Abstract – The article focuses on some software aspects, allowing the use of cloud technologies in the field of technological education. The authors proceed from the understanding of cloud technologies as a resource for expanding the innovation culture of teachers, on the one side, and to impart greater efficiency of interactive interaction between teacher and students and other participants in the educational process on the other side. The advent of cloud technologies in education led to the creation of new models of teaching and learning in an interactive and engaging learning environment. They provided new opportunities for the preparation and development of web-based learning resources.

I. INTRODUCTION

The actuality of cloud technologies does not need evidence provided, because specialists in the IT sector accounted ascending increased use of cloud services in different areas and mainly in the development of highly effective business projects. How and what cloud solutions are possible in education is an issue that requires timely analysis of best practices, the development and experimentation of methodological models tailored to specific educational environment, such as the environment for technological education in Bulgarian schools.

From a methodological point of view to consider cloud technologies as an element of innovation culture, manifestations of which have the potential to achieve competitive advantages, including in the educational process and technological education. From the didactic point of view, cloud technologies will consider increasing the efficiency of interactive interaction typical of the philosophy of technological education, namely: "I have an idea," "think together" and "to do together". Regarding the knowledge, skills and competencies of teachers are needed for the generation of cloud solutions in educational practice, it is quite reasonable to consider cloud technologies in the context of his competency profile [1]. Arguments along these lines we found in the ascertainment of the Program for International Student Assessment PISA, saying that "students use computers at home mostly for entertainment and quite rarely for school activities" [2].

II. CLOUD TECHNOLOGIES IN TECHNICAL EDUCATION

Microsof Office 365 Education and Google for Education are cloud services, that provide an opportunity for use in the education of e-mail, contact lists, calendars, storage space for documents, create and share documents and the ability to create websites. Cloud technologies YouTube Video Editor and Wevideo are designed for video processing.

Office 365 Education of Microsoft offers cloud services for education, that can be used in the technological education:

- **Outlook** is email, that provides 50 Gb space for messages for every single user. Arranges incoming emails by subject / date for easier and fast opening;
- **OneNote**, teacher can use for optimize their work. Ability to create different notebooks. Visual view of teachers and students. Setting, implementation and verification of homework - introduces students homework and the teacher can verify it, even through your phone;
- **Skype** enables online meetings without limitation, instant messaging, audio, HD video, web conferencing and virtual tours; [5]
- **OneDrive** provides 1 TB of storage for each user. Ability to share individual files or whole folders with the whole team and with individuals - teachers, students and people outside the organization (parents);
- **Office Online** to quickly and easily create a variety of documents, spreadsheets and presentations online;
- **Calendar**, which allows to maintain multiple calendars simultaneously to different people - a great way to manage staff schedules and planning events, parent meetings, exams. Supports reminders options - via SMS or email;

- **SharePoint** is designed to create websites by teachers and students for the purpose of school projects. Easily create discussion forums for teachers, students and parents, document libraries, tools for project management and calendars.
- **Classroom** helps teachers supports organized many classes and / or classes and share projects and feedback;
- **Sway** to visualize the lessons summarization of projects to provide additional materials for parents to provide their students with new tools for story telling, etc. Sway also allows students to import creativity and a new life to school projects, school reports and even personal performance;
- **Snip** is the application, which can capture a screen shot, a picture with your webcam. The application allows sharing via email or provide inserted into the website. Teachers can use Snip, to give personalized feedback to students, and students use Snip, to express their creativity and work in teams with classmates and teachers;
- **Microsoft YouthSpark Hub** It offers a variety of resources and programs to develop digital skills and studying computer science aimed at students to prepare them to start work successfully in the future or even to start their own business;
- **Microsoft Imagine** applications and resources are available to teachers free of charge and allow their students to learn about the basics of programming through fun projects;
- **Imagine Cup** competition hub It allows students to use the received basic knowledge and create technologies;
- **Imagine Cup Earth** – partnership with NASA, includes both programming and science. All these resources inspire students to develop their abilities to realize their ideas and earn rewards. And for those who want to create club programming can seek help from Coding Club Starter Kit;
- **Microsoft Virtual Academy** offers free courses in computer science for students of all levels of knowledge, while at the same time provides an opportunity for teachers to better integrate technology into their programs.
- **Google Classroom** which teachers can easily organized in a convenient electronic form learning process, create and check assignments and work of students, the files are automatically structured into folders and documents in the cloud repository Drive for easy access from anywhere. On assignment students see what is the problem and immediately proceed to its implementation. Implementation data are updated in real time and the teacher can immediately begin checking the work to put evaluations and to add comments. Individual assignments are supported. Through Classroom teacher can spread messages and initiate discussions, and the students - to share materials with each other and respond to questions posed by the teacher questions. Currently Classroom Service is available in 42 languages and in the Bulgarian language and is optimized for mobile devices and for e-book readers. To use the service at classroom.google.com must indicate status (teacher or student), then gets the opportunity to create a new course or join an existing one.
- **Google Apps** is a suite of free tools, which in turn includes: Gmail, Calendar, Google Sites, Google Docs. Google Apps enables collaboration and communication regardless of location and device used.
- **Google Docs**, that make file transfer easy for teachers and students;
- **Google Calendar** to track important dates and tasks, always stays synchronized with your phone;
- **Blogger** A system for blogs, a combination of software and services for the creation, maintenance and hosting them. From an educational point of view, blogs allow teachers and students to collaborate, share learning resources, create content and connect with major social media channels such as YouTube, podcasts, other blogs, tweets, social bookmarks, etc. all on one page.
- **Google Sites** is a free platform for creating web pages. allowing to create a free sites using the provided templates. The users will need not to know the language HTML - the process of creating and editing a website is using a specially developed interface. The main advantage of Google Sites is accessible - fully work on the Internet, there is no need to install additional programs. Using only the basic functions the service is free,

and each account are available up to 10 GB of space.[4]

The only requirement for using cloud services is creating a profile on Google, which opened a huge portal of applications required to meet the needs of new learners..

Cloud Technologies video processing, which have an easy and intuitive interface and can be used in technological education are:

- **YouTube Video Editor**, through it possible to cut part of the video to add music, set transitions and even video stabilization. With the help of this cloud service is able to create interactive presentations using pictures from library or taken with a phone or camera;
- **Wevideo** is a cloud service that has a simple interface for editing video files. It has a library of audio recordings. The video created by Wevideo can be directly uploaded to YouTube, Google device, Facebook and Twitter. You can change the resolution of the video or set visibility as can be selected as "private or public".

III. CONCLUSION

The integration of cloud technologies in technological education is determined by social needs and expectations for the modernization of the educational process.[1] Education cloud provides new opportunities for the development of technological training 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.

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Near Field Communication, QR Code and Barcode Scanner Communication With Windows Form Aplication

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Abstract – Near Field Communication (NFC), Quick Response (QR) and bar codes open up a wide range of options in the form of process automation. With a daily presence and use of smart, Android and iOS, devices with the support of the applications, possibilities are limitless.

The idea for this project came due to the desire for automating tokens on a traditional students event. Windows form application with SQL Server database associated with the android smartphone by simply scanning the card, will enable fast, easy and reliable way to record consumption.

I. INTRODUCTION

This project makes communication between android application, intaled on adnroid phone with integrated NFC reader, that coomunicate with PC through wireless network.

PC is running windows form application connected to a database located on SQL Server Express on server computer in that Local network. SQL Server Express allows stable and reliable connecton with database in, this case, local network.

II. ABOUT USED TEHNOLOGIES

A. Microsoft SQL Server Management Studio

Microsoft SQL Server Management Studio (SSMS) is an integrated environment to manage a SQL Server infrastructure. It provides a user interface and a group of tools with rich script editors that interact with SQL Server. SQL Server Management Studio provides tools to configure, manage and administer instances of Microsoft SQL Server, and it brings together a range of graphical and visual design tools and rich script editors to simplify working with SQL Server. SSMS combined features come from Enterprise Manager, Query Analyzer and Analysis Manager, along with features included in previous releases

Of SQL Server. It supports most of SQL Server's administrative tasks and maintains a single, integrated environment for SQL Server Database Engine management and authoring [1, 5].

Figure 1. Micorsoft SQL Server logo

B. Microsoft Visual Studio 2015

Microsoft Visual Studio 2015, is program for the development of both graphical and console applications, and a variety of web applications, sites, services, and Windows Store apps. Developed by the company "Microsoft", proved to be a very good development environment as it helps in programming in a way that automatically generates code that simplifies the programming process itself. It comes with a built-in C # and C ++, VB .NET (Visual Basic .NET). You can program in other programming languages such as JavaScript, CSS, XML, and HTML. Installing language service development environment. Microsoft Visual Studio is one of the most popular development environment that provides great opportunities for the development of programs and their flaws are corrected to some extent by various extensions developed by both "Microsoft" and by other programmers. Microsoft is very well developed finding and removing errors in programming is therefore a very popular and useful tool developers. [2] [3] [4]

Figure 2. Microsoft Visual Studio logo

III. DESIGN OF APLICATION

PC application is created in C# programing language, for design environment is used Visual Studio 2015 Community witch is intended for education purposes and students. Database contains one table with two integer values which are used to count consummations of food and drink that day.

Database is located on SQL Server Express and so it can be used from all computers connected to that network that allows placing multiple scanners in LAN area.

For scanner is used android smartphone with installed CLZBarry application connected to computer through virtual server installed, and it turns android phone to NFC, QR or barcode scanner using phone's camera.

When application .exe file is started application pops up a panel with two text boxes and one confirmation button. It allows user to change limit of consummation. When user set limit with typing two integer values into text boxes, then confirmation button lets him into application.

Figure 3. Figure 3. Startup screen

On Figure 4 is shown form when is clicked on Add Code button. On click user is opening drop-down menu with data grid view witch is previewing database table values. Database have three columns, column named "Barcode" is primary key, because of that there cannot be two same barcodes in database. Other two columns are for counting consummation, one for food, second for drink. These two columns are integer type, and they are used as consummation counters.

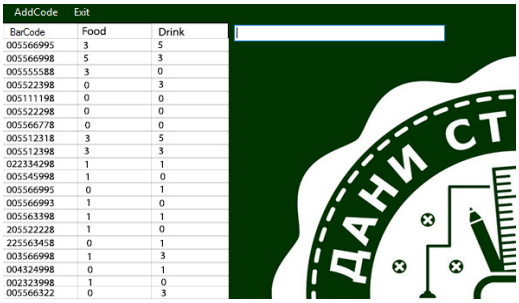

Figure 4. Database preview

When limit is reached, user is getting message that card is empty.

Figure 5. Limit reached

All data, every scan is saved into SQL Server and Server manager gives us an easy way to select data suitable for work and analyze, as we can see on Figure 6.

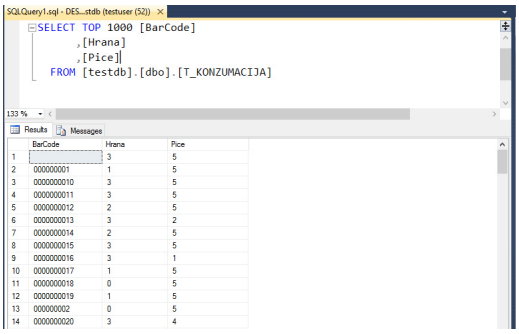

Figure 6. SQL Server Management studio preview

SQL Server Express provide us speed communication through the local network. Router with wireless ability is enough for stable client-server communication. On the figure below is graphically demonstrated local network with clients and server.

Figure 7. Network graph

SQL Server Configuration Manager allows you to manage server and client network protocols, including the ability to force protocol encryption, view alias properties, or enable/disable a protocol. [6]

SQL Server Agent uses SQL Server to store job information. Jobs contain one or more job steps. Each step contains its own task, for example, backing up a database.

SQL Server Agent can run a job on a schedule, in response to a specific event, or on demand. For example, if you want to back up all the company servers every weekday after hours, you can automate this task. Schedule the backup to run after 22:00 Monday through Friday; if the backup encounters a problem, SQL Server Agent can record the event and notify you.[7]

The SQL Server Browser program runs as a Windows service. SQL Server Browser listens for incoming requests for Microsoft SQL Server resources and provides information about SQL Server instances installed on the computer. SQL Server Browser contributes to the following actions:

- Browsing a list of available servers
- Connecting to the correct server instance
- Connecting to dedicated administrator connection (DAC) endpoints

For each instance of the Database Engine and SSAS, the SQL Server Browser service (sqlbrowser) provides the instance name and the version number. SQL Server Browser is installed with SQL Server, and provides this service for earlier versions of SQL Server that are running on that computer. [7]

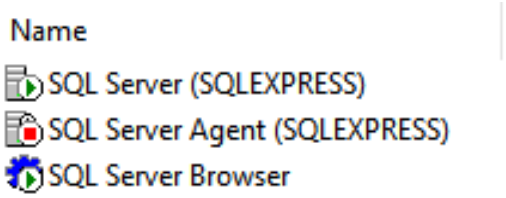

Figure 8. SQL Server Services

IV. PARTS OF CODE

In this part are presented important parts of program's code and connection to database.

On Figure 9 is shown connection String that provides connection to SQL Server database. It contains location (IP address on server) of database, user ID and password that provides login.

```
string _connectionString =
"Data Source=192.168.1.100;Initial Catalog=testdb;User ID=testuser;Password=*****";
```

Figure 9. Connection string

Figure 10 is showing method that provides insert data into database. This method is used for inserting barcodes into database. This method is called on key event. I make Enter key event for insert, and set same event as default on mobile device to speed up an inserting process Figure 11.

```
public void dodajBrCode()
{

    string insertSql = "INSERT INTO T_KONZUMACIJA " +
        "(BarCode, Hrana, Pice) VALUES " +
        "(@BarCode, @Hrana, @Pice)";
    using (SqlConnection connection = new SqlConnection(_connectionString))
    {
        SqlCommand command = connection.CreateCommand();
        command.CommandText = insertSql;
        command.Parameters.Add(new SqlParameter("@BarCode", BarCode));
        command.Parameters.Add(new SqlParameter("@Hrana", Hrana));
        command.Parameters.Add(new SqlParameter("@Pice", Pice));
        connection.Open();
        command.ExecuteNonQuery();
    }
}
```

Figure 10. Insert method

```
private void txtBarCode_KeyDown(object sender, KeyEventArgs e)
{
    if (e.KeyCode == Keys.Enter)
    {
        if (dataGridView1.Visible)
        {
            btnAdd_Click(sender, e);
        }
        else
        {
            granica();
            provera();
            slika();
        }
    }
}
```

Figure 11. Enter key event

Bellow I will present you how I designed method for limit checkup, and it's called on every insert or update of database table.

```
private void provera()
{
        SqlConnection con = new SqlConnection(_connectionString);
        cmd = new SqlCommand("SELECT * FROM T_KONZUMACIJA WHERE BarCode = @BarCode" +
            " "AND (Pice<"+granicaPice+" OR Hrana<"+granicaHrana+")", con);
        cmd.Parameters.Add(new SqlParameter("@BarCode", txtBarCode.Text));
        con.Open();
        SqlDataReader reader = cmd.ExecuteReader();

    if ((reader.Read() == true))
        {
            panel1.Show();
            label4.Text = Convert.ToString(reader.GetInt32(1));
            label3.Text = Convert.ToString(reader.GetInt32(2));
            label5.Text = "0";
            label6.Text = "0";


        btnpice.Focus();
        }
    else
        {
        cancel();
        txtBarCode.Text = "";
        txtBarCode.Focus();
    }
    con.Close();
```

Figure 12. Method for checking database

V. CONCLUSION

This project is another example how we can simplify and speed up many processes using NFC or barcodes scanners. Near field communication found its use in payment systems. No need to carry multiple credit cards, no more lost tickets. NFC technology is gaining popularity day by day as an effective system.

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Customizable Mobile Components as Supporting Tools for Blended Learning

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Abstract - Combining mobile technology to work on the go becomes very popular in the world today. The development of cross-platform technology enables easier and more effective way of access to mobile platforms by reducing costs and creating opportunities for productive collaboration. In this paper we describe four cross-platform components for blended learning intended for collaboration between students. The created programmable components allow cooperation through transfer of educational material, educational animated video content and shared environment for collaboration on a given task in a university environment. Test results for these components show considerable interest among students to use this type of tools. The proposed tools are flexible and can be edited as needed.

I. INTRODUCTION

The purpose of this paper is to present a model of customizable mobile components for advanced teaching and learning using smart mobile devices. Today, pupils and students mostly perform their school related tasks using their smartphones, tablets and smart watches. The younger population use mobile devices to constantly be active online, which opens up a huge opportunity for advanced implementation of mobile devices in the educational process. The use of mobile devices in the educational process in the classroom and outside of the classroom allows advanced interaction between students, it helps the process of distance learning, allows sharing of videos, learning through games based on mobile phone, educational materials with animated content, etc.

For this purpose, we have created four multi-platform mobile components that can be adjusted according to user needs. The components are designed for mobile platforms iOS and Android and can be used as separate applications or adaptable modules for implementation in other mobile applications. The first component refers to the distance learning and it is called "Online Learning" component. The second component relates to taking the tests using mobile devices from the pupil / student. The third component is called collaboration component and provides modern interaction between teacher and students outside and inside the classroom through the exchange of educational materials and deciding on a particular task. The last component is designed for teachers and refers to the management of the previous three components.

II. RELATED WORK

Different ways of applying modern technology in the educational process are presented in the literature. Many authors in their research papers are presenting different benefit from the applications of modern mobile devices and advanced technology into practice in the educational process. According to some authors, if mobile phones are used for education, they are getting a double benefit because the education bears out of the classrooms and carry social resources back in schools [1]. Additionally, in the literature there are authors who believe that the quality of the educational process in developing countries can be significantly increased by the application of advanced technologies [2]. Author Makoe concludes that the use of mobile devices in the educational process provides a significant contribution to education in developing countries because it allows access to information for the less privileged. [3] In several places in the literature there are mentions for the lack of will to implement these technologies in the educational process due to a fear that the process can be disturbed by mobile devices. The authors in [4] stated that they conducted a survey of a sample of 100 students which showed that the use of mobile devices in the classroom is still limited due to fear of teachers that digital devices will reduce the quality of education. According to the research in this study, students want to use mobile devices in the teaching process, but for the teachers there is a need for determine positive effects of application and presentation of a real practice prove about the positive income of these educational tools. The studies have shown that in practice often can be found informal

attempts for using mobile devices as alternative or helpful tools in the educational process.

III. DESCRIPTION OF THE PROPOSED COMPONENTS

As it was mentioned above as part of this research we created four experimental programmable components designed for mobile platforms iOS and Android. The components are flexible and adaptable and can be adjusted by the user to meet his needs. In this section we will give detailed description of the four proposed components. All components are oriented for multiplatform use, written in combination of JavaScript and Flex technologies. For the purpose of this research we used Development Certificate for iOS devices. The proposed components are original and ready for implementation in different educational environments.

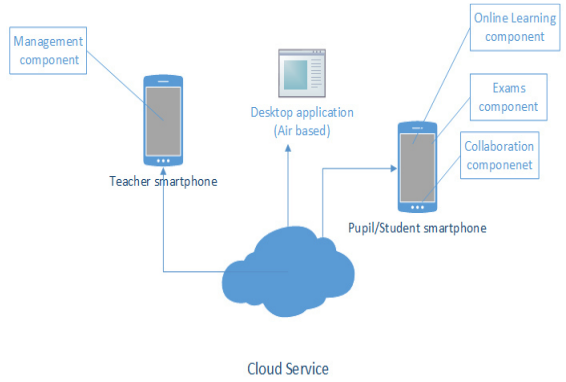

Figure 1. Visual representation of the implementation of proposed components

A. *The Online Learning Component*

The first component is called "Online Learning". This component integrates functionalities for monitoring webinars, electronic lectures, presentations and video content. The component includes special features designed for digital educational materials that contain animated content. The component is based on Adobe Air technology and it`s adapted to be able to work with Flash animated content in the form of animated flashcards that are meant to be a substitute for the standard educational materials based only on text and static images.

We believe that this approach may be particularly useful for certain students such as medical students, who often needs to practically see what are they reading in form of animation to better understand the lecture. In order to activate the component and gain access to the created educational materials, it is required for the user to be previously registered with the IMEI code of the mobile device in the database. Only registered devices have access to the content of this component. All user data and shared materials are stored in a cloud based server. It can be implemented using the most appropriate cloud solution implementation and also a solution based on a local server that will be in charge to serve the proposed components within this paper. For the purposes of this study we have used combined local Linux server and cloud based server implemented on Amazon Web Services (AWS) platform. The presentation of the functioning of Online Learning component is shown in Figure 1.

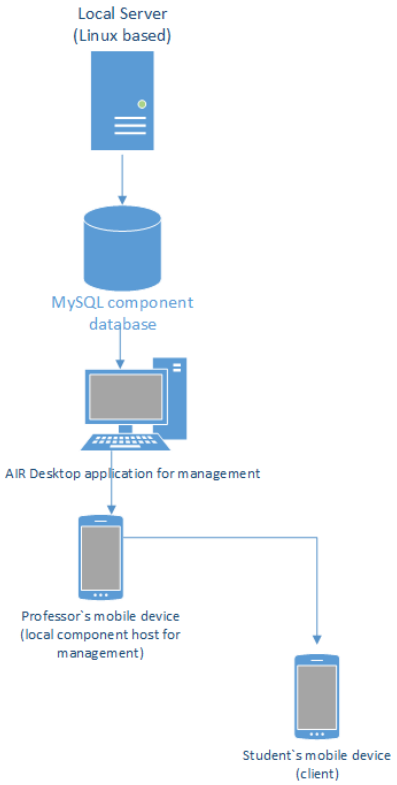

Figure 2. Schematic representation of the functionalities of online learning component

B. *Exams component*

This component refers to the possibility of implementing electronic exams using student's mobile devices in or out of the classroom in real time. To use this component, the user's device must be previously registered in the customer database in order to be recognized by the component. Testing is performed in two ways. The first way is based on questions with offered answers.

The second way is presenting questions, to which the user can give verbal answer. The component integrates the ability to record the obtained answers in the form of audio files, saving

them to the server and creating a hyperlink to them so they can be verified later by the professor. Figure 2 shows a diagram of the activities carried out with the help of this component.

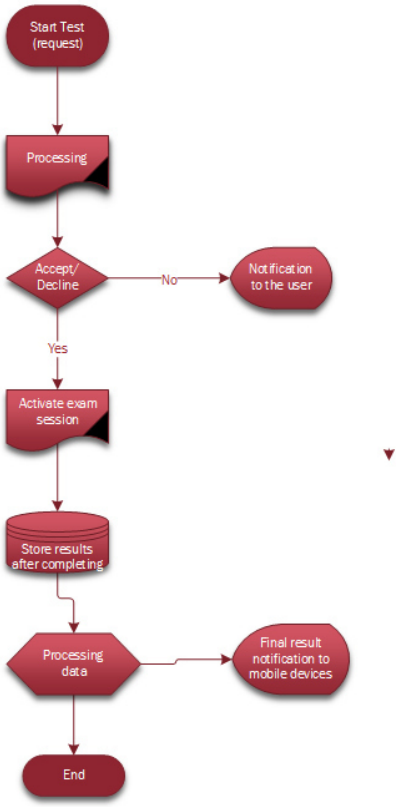

Figure 3. Exams component activity diagram

In order to receive questions and begin to take the test, users previously need to demand access by simply clicking the button "Start Test", after that it will open an input form for 6-digit code that will be provided to the user by SMS. To test the solution, we have used SMS provider. For the operation of the components we previously developed AIR based desktop application through which the safety components are managed. The request for the entry is sent to the mobile device of the professor, the professor through the inbuilt component for management can approve it or reject it. If he approves the request, so called "active session code" will be sent to the user, the code lasts 1 hour. During the specified time the student is obliged to complete the test. The duration of the code for an active session can be changed only by the professor using the desktop application. In case of test with oral responses, the professor will receive notification upon completion of the test on his mobile device and is obliged to check the received answers. The number of obtained points, the type of questions and tests are created using the desktop application.

C. *Collaboration component*

The third component is called collaboration component. The objective of this component is that students can cooperate in a contemporary way to cooperate among themselves in the classroom and outside of the classroom. The component enables connectivity to social networks such as Facebook and Twitter and direct sharing of materials on social networks. The built in programming logic within this component allows monitoring of the activities of students in real time using a desktop application. Active Tracking module which is implemented in this component allows monitoring of the activities of the user. The user activities that are undertaken in the performance of a specific task are recorded as the log file on the server and are available for analysis of teachers in order to determine the errors that student made in solving the problem. This component offers the opportunity for group solving a specific task which can work a maximum of 8 students (this can be changed through the desktop application). The solutions to the problem can be exported in various formats (pdf, xml, and doc) depending on the needs, and can be directly sent by email.

D. *Management component*

The final component is called a management component. This component is strictly designed for installation on mobile devices of the teaching staff. The idea of this component is to serve as a mobile controller of students work with the other three components. Using this component, teachers and other stuff related users can create tests, approve requests for access to educational resources, create tasks for specific student or group of students and collectively to evaluate the achieved results. The setup of this component is performed using a desktop application that is designed for teachers.

IV. DISCUSSION

The presented components were technically tested within two months. During the implementation of the proposed components which can be presented as mobile applications or to serve as a complement for mobile applications, it is important for the developer to be satisfied with the technical features, because than the components can be adapted easily to fit the needs of the end users. The components are designed in a way that can be directly installed on the mobile device as demo versions for testing. The tests of the technical characteristics have shown the occurrence of errors, during data processing from iOS tablet devices and some Android mobile devices. These errors are removed during the second phase of

testing. Because the components were multiplatform oriented, we needed more time to test the functional and technical characteristics of components in order to work equally on different operating systems and mobile devices with different hardware features. To enhance the functional and technical characteristics we used profiling tools for Air based mobile applications and cloud based services for application testing like AWS Device Farm to test the components with different mobile devices simultaneously. It is important to note that the components can be adapted to web-based interface in order to be used in the browser. The components exchange data with the server via XML and PHP data services. For us it was extremely important to design a functional solution to qualify the proposed components. The components were tested only with virtual users and have not been tested in a real environment.

For the full implementation it is necessary to test their practical value in real environment. During the winter term we conducted an online survey among students of the first year of Faculty of Philology, designed for this research. Survey question concerned the use of mobile devices as tools for education. About 106 students took part in this research by answering the survey questions. The results of the survey have shown considerable interest among students for the use of this kind of technologies. Most of the students said that they cannot use mobile devices in everyday educational process, although they wish because there is still no suitable material made for mobile devices. That was the main reason for making the first few components, which can be upgraded in the future.

V. CONCLUSION

The use of mobile devices as educational tools is the future of education. Studies have shown that most students want to use modern technologies for learning, because they are making the process more interesting, interactive and fun. In this paper we presented four multiplatform components for mobile applications based on Flex technology. In the future it is necessary to develop additional components and mobile applications that will be adaptable to the educational contents. The proposed components in this paper have experimental character, the aim was to investigate the practical possibilities of technology for creating modern educational tools.

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A View to the Impact of Some VR-Technologies in an Education of Disabled People

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Abstract - New technologies and information technologies especially impact our daily life in many significant ways. Despite there is a lack of availability of some technologies to the wide public caused by their location and price. This insufficiency seems to be even bigger for handicapped people and it is more bigger if they are a children. LIRKIS laboratory of Technical university of Košice proposes solutions in education of these people and develops technologies of virtual reality which are capable to fulfill their needs. One such VR technology is the CAVE system, which is also in the LIRKIS laboratory and gives a new dimension for further educational opportunities.

I. INTRODUCTION

Virtual reality (VR) systems, user interfaces and human-computer interaction (HCI [1]) have more and more influence on our lives. There are solutions and technological possibilities which includes VR in daily activities, entertainment, trainings, industrial improvements, education or rehabilitations. Based on a study that predicts an increase in the availability and use of VR until 2018, is possible to considered this technology as suitable in finding new solutions [2]. It provides a solid ground for a fundamental change in human-computer interaction in a way that will make the interfaces simpler and more natural for people, including those with handicaps.

VR system is an interactive computer system that can create an illusion of physical presence in an imaginary or real world [3]. When compared with other computer-based systems, virtual-reality systems are more interactive but, on the other hand, the cost of their implementation is higher. Each VR system is a composition of subsystems dedicated to individual senses: visualization subsystem, acoustic subsystem, kinematic and statokinetic subsystem, subsystems of touch and feel and other senses (e.g. smell and taste). Some of the real-world senses are omitted because they are too hard to implement or are not essential for HCI. An example of such sense is taste. Although handicapped persons are not the primary target group of virtual-reality technologies and systems, we can see the rising number of implementations of these technologies for their benefit. When applied correctly, they can help people with both physical and intellectual disabilities. In the rest of the paper we overview research and development results, achieved in this area by the authors and others. Conclusion describes the results and also discusses other possibilities of VR technologies utilization for corresponding handicaps. More detailed description of selected results can be found in [4], [5], [6], [7], [8]. The practical experience of our team has been obtained in cooperation with Pavol Sabadoš special boarding school in Prešov, Slovakia, which focuses on handicapped children with mental and physical disabilities.

II. TYPE OF DISABILITIES AND NEW INFORMATION AND COMMUNICATION TECHNOLOGIES

Handicapped users are not only users with physical or sensory disabilities but also cognitively impaired ones (e.g. users with learning disabilities or concentration problems) and VR technologies should be primarily used to create a natural user interface [9] with improved accessibility for them.

To be able to create such a user interface it is necessary to understand how they access information and what their specific problems and needs are. They are specific with respect to individual disabilities, which can be divided into the following categories:

- Physical disabilities (gross and fine motor skill disorders, limited mobility, etc.),
- Sensory disabilities like hearing impairment, visual impairment and sensory impairments (e.g. olfactory and gustatory impairment),
- Intellectual disability (e.g. caused by the Down syndrome),

- emotional and behavioral disabilities (i.e. decreased ability to communicate by speech)
- learning disabilities (reading disorder, disorder of written expression, math disability, etc.) and
- other disabilities (different kinds of addictions, senility, etc.).

Impaired people need to use supporting technologies to work with computers [10], mainly alternative user interface tools such as readers (text to speech software) or screen magnifiers. According to [11] information and communication technologies can help impaired people primarily in the areas as making access to information easier, assistance in recovery from disabilities, assistance with daily activities, communication with intact people and preparation of specific teaching materials and tools for impaired people this important area for our team). The most supported groups nowadays are visually and hearing impaired, less supported are cognitively and physically impaired (This is despite the fact that one of the first use of VR for the impaired was a training of disabled persons in wheelchairs in virtual environment).

A. Physical disabilities

Physical disability means a limitation on a person's physical functioning and results in a decreased mobility, dexterity or stamina. For people with this disability it is very important to have computer input devices appropriately adjusted and modified [12]. These modifications include altered functioning of classical input devices, such as so-called "sticky keys" feature to assist in holding down multiple keys simultaneously, on-screen keyboards or mouse-controlled keyboard. There are also special input devices, for example mouth-controlled mouse or eye movement tracking systems.

Most of the items mentioned just emulate the function of classical input devices – the mouse and keyboard. From the VR point of view, it is also possible to use the devices mentioned in the previous sections, especially the contactless sensors, muscle tension sensors and EEG machines. For rehabilitation and training of disabled persons a utilization of augmented reality technologies seems to be very promising. The augmented reality (AR) is similar to VR, but differs in using real-world objects and not only virtual ones. AR technologies are used to insert virtual (i.e. computer-generated) objects into a live view of a real-world environment and manipulate these objects. The utilization of AR for the rehabilitation can be in a form of a "virtual training table" device. The device will consist of a real table, a video projector, a motion tracking sensor and a computer. The projector will project some image on the table (e.g. some keyboard) and the task for the person will be to hit part of the image. The sensor will track movement of the person's hand and the computer will evaluate the movement. The device can be used for training gross and fine motor skills of the physically disabled. An example of using such technologies for rehabilitation purposes is a special shoe, described in [13]. Considering other VR technologies, we can also utilize 3D printers, which can be used to print various aids, such as prostheses [14].

B. Intellectual disabilities

Cognitively impaired persons have problems with solving one or multiple types of mental tasks [15]. This impairment usually manifests in decreased ability to process information and to recognize connections between pieces of information. It is not easy to create a user interface for cognitively impaired as it has to provide an easy and clear navigation. Words used should be simple and unambiguous. It has to be clear what is a label, a caption or a navigation element. The structure of the interface should be expressed visually (i.e. using various font types and sizes) and semantically [16]. It is recommended to illustrate meaning of words with pictures (icons, photos) or animations. The ordinary text should be bigger than usually. The same is true for an unused space around interface elements as it should be clear where their borders are. Using 3D displays can be also useful, but they should be autostereoscopic, i.e. without a need to wear additional equipment (glasses). The most suitable input devices for cognitively impaired are touch screen displays, because they are natural and intuitive. However, the screens should be medium to big size as a significant number of these people have problems with motor skills, too.

C. Sensory disabilities

Nowadays, the visually impaired can use assistive technologies in the form of screen magnifiers, text to speech software or tactile aids, such as a refreshable braille display or a braille embosser (printer) [17]. Some of them are directly supported by contemporary operating systems. At the home institution of the authors a project called MAPZ has been carried out, which focused on a development of a device that improves blind people mobility. The device consists of a software

application for smartphones and a special belt. The application can assist during stairs walking or connect the impaired person with a remote operator who helps the impaired to pass difficult areas such as crossroads. The belt is equipped with vibrating alert motors, accelerometer and other sensors and thus can serve as an intelligent replacement of the white cane. The belt uses its sensors and vibration motors to detect and notify obstacles to the user and is connected to the application. Vibrations can also be used to navigate the person. Albeit the device has been developed outside LIRKIS, the laboratory contributed to it by 3D printing a part of the belt.

Hearing disability limits the use of computers far less than the visual one. The only significant limitation is inability or decreased ability to perceive audio information. To avoid this limitation, the information should be also provided in a visual form, i.e. as pictures or text (subtitles). Contemporary technologies also allow real-time speech recognition (speech to text translation). While not entirely reliable, it can significantly increase understanding when the visual form of information is not available.

A classical mean of communication, used by deaf people for centuries, are sign languages. Here information and VR technologies can help with translation between a sign language and a natural language or between various sign language dialects. They can also assist in teaching sign languages. The fundamental issue here is gesture (sign) recognition and there are several ways in which this can be implemented using VR technologies. For example, a gesture recognition can use image recognition, data gloves, contactless movement capturing sensors, muscle tension sensors, EEG scanners or Eye movement sensors.

Prototype gesture (sign) translators, implementing the first three technologies, have been developed at the LIRKIS lab. Some experiments with the last method (using single channel EEG) have been carried out, too. Based on our experiences, we see the biggest advantage of image recognition in the fact that it can be implemented using standard devices, such as smartphones or tablets with camera and in its contactless nature. On the other hand, its accuracy varies significantly and strongly depends on light and other conditions at the time the gesture is captured. Utilization of data gloves provides faster and more precise recognition but it can be too uncomfortable to wear additional equipment for some handicapped users. Data gloves also represent a specific type of equipment, which is not cheap. The third method, which uses contactless sensors such as Microsoft Kinect, is fast, accurate and comfortable. Special case is using of hand motion sensor in virtual CAVE. However, size and price of these sensors limits its usability.

Muscle tension sensors are contact sensors (i.e. there is a need to wear them) but are more comfortable than data gloves and can communicate with other devices wirelessly. EEG scans brain activity, so it allows us to capture an intention to make a gesture (or say a word) instead of the gesture (word) itself. This can be very useful for persons with multiple handicaps. A serious disadvantage here is a relatively high price of more precise (multichannel) EEG.

III. VIRTUAL AND MIXED REALITY TECHNOLOGIES IN LIRKIS LABORATORY

LIRKIS is an excellent laboratory for virtual reality and advanced interfaces for communication and information systems. Laboratory is a home institution of the authors. The basic infrastructure of the laboratory covers all phases of virtualization sequence (Fig. 1) and offers a chance to work with a wide range of devices.

Figure 1. Virtualisation sequence

A 3D scanning is used for the analysis and collection of data from a real-world objects or environment. For the visualization phase of LIRKIS lab, several options are available. There are various 3D imaging technologies, either stereoscopic displays or 3D display, that can show image without glasses or any additional devices.

Special type of 3D view is CAVE (Cave Automatic Virtual Environment). It is a room where the walls, as well as the floor and ceiling are projection screens or flat displays. With the 3D projection and 3D glasses user feels immersed into the projected world where he can move freely. Human motion capture is possible with camera-based systems such as OptiTrack, which captures the movement via special markers. A marker may be attached to the 3D glasses, so the scene can be displayed in the correct viewing angle for the user. This enables, for example, to really look under a table after moving the head down.

The CAVE system, available in LIRKIS (Fig. 2) is of unique, cylinder based construction. It consists of twenty 55” 3D LCD TVs with passive 3D technology and circular polarization. The TVs are distributed along the sides (14 TVs) as well as the top (3 TVs) and the bottom (3 TVs). They are

supported by a steel frame (about 2.5x2.5x3 meters), that can be disassembled at any time and transferred to another location. This provides a significant advantage, although the total weight is about 2 tons.

Figure 2. CAVE system in LIRKIS laboratory. The OptiTrack camera can be seen in red square.

The bottom TVs are installed under a safety glass that can support the weight of 5 adults. The system of eight OptiTrack Flex 13 cameras is used for the detection of human movement (Fig. 2). They are arranged along the top of the CAVE to provide the best capturing performance. In the current configuration, with one marker mounted to the 3D glasses, only rigid body monitoring and streaming is possible. Therefore, we intend to use a hand kit to track hands and all fingers. The CAVE it also equipped with a 6-channel audio system that adds to the illusion of a 3D environment. The entire CAVE is powered by 7 computers, embedded in a rack, each with NVIDIA Quadro K5000 graphic card. Each computer, except one which manages the computation, produced image for 3 to 4 TVs as one part of a whole 3D screen.

For immersive virtual reality, the Oculus Rift HMD can be used. The laboratory also provides MS Kinect, whose skeletal sensor is used in our KPI-CGRS desktop application. This software enables gesture recognition based on movements of arms.

The laboratory has also mixed reality possibilities via head-mounted displays (HMD). The see-through HMD displays (NVIS nVisor ST 60) are available (Fig. 3), where a user can see images in real world.

Figure 3. Students and augmented reality with data helmet (LIRKIS).

The latest device of this type is Microsoft HoloLens [18], LIRKIS laboratory has own experience with this device, but only in testing (Fig. 4). Compared to nVisor-ST60, device works wirelessly, it is controlled by hand gestures and the entire computing system is in a helmet. Weight of whole HMD system is only 580 g and for this reason is device more user-friendly. Due to new embedded technologies (CPU, HPU, sensors, sound system, etc.) has device more possibilities to development.

Figure 4. Microsoft HoloLens (left) and user working with this device (right).

The printing phase of the virtualization sequence is ensured by 3D printer, where a three-dimensional object (3D model) is created by laying down successive layers of material.

IV. Education of Disabled People and LIRKIS Laboratory

To observe the effects of technologies available at LIRKIS to the handicapped children we arrange an opportunity to visit the lab for them. The greatest interest was in the CAVE through immersion in the virtual world (Fig. 5). This created children's interest and evoked various emotions (fear of heights, imbalance, surprise, etc.).

Given the various types of disabilities, not all of the devices were suitable for each child. For example, with fine motor skill disorder it was difficult to control a 3D scene using the mouse.

Figure 5. Children in the virtual CAVE environment (LIRKIS)

However, it showed the potential for possible improvements in the user interface with a focus on the problem (e.g. The KPI-CGRS has an interface applicable to sign language).

In cooperation with Pavol Sabadoš special boarding school in Prešov, laboratory developed some special devices and applications for handicapped schoolchildren.

Thanks to reduction of prices and increased quality of touch screens, touch interfaces became more and more common in mobile applications. The main advantages of this type of control are:

- absence of input peripheral devices,
- compactness and intuitiveness,
- low implementation cost and
- reduction of mental burden of the user [19].

The design of user interface focusing on visual part of the computing process output is based on thirteen principles of perception and processing this information from user. The principles can be divided to specific categories:

- perceptual principles,
- principles of mental model,
- principles based on attention,
- memory principles [20].

During the development of user interface including touch interface, the method has been applied of repeating processes of designing, testing and result evaluation. This method can be applied after the user identification, identification of tasks (they will be transferred through the interface) and also the way to implement the empirical evaluation.

An interactive school desk has been developed at LIRKIS (Fig. 6), which uses a 24-inch touch screen LCD. The desk was used in education of children using special symbolic-text method [16], [21] with multiple handicaps, including cognitive, and the size of the display has been found sufficient. Currently, school-desk consisting of two displays and supporting the augmented reality is under development. At the time of writing this article, the development is in the stage of prototyping. Then will be placed and tested in the educational process at Pavol Sabadoš special boarding school in Prešov.

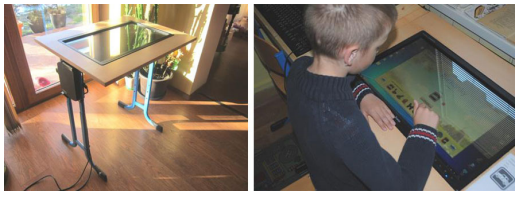

Figure 6. Interactive school desk (left) and using by child (right)

This environment and the tools presented in the paper create an ideal chance to truly understand the needs of handicapped people, children in particular, and adjust the tools to their needs. The field-testing started in 2012 and includes also other solutions, such as software adjusted for deaf and mute children (sign language). However, the practical usability of the tool based on the mobile technologies and image recognition is for now limited by insufficient transmission capacity and speed of mobile networks and performance of mobile devices. Size of gesture databases, requirements of search algorithms and communication management were the most significant issues. But the development of supporting technologies, e.g. the ones presented in [22] and [23], decreases the significance of these problems. This is very positive as such mobile applications can significantly help in the integration of deaf-mute people into the society. Availability of mobile sign language translators allows the ordinary people, who usually do not possess the knowledge of sign languages, to understand them and vice versa.

The best results were achieved with the KPI-CGRS software (mention before). It was comfortable for children and well received by educators. The educators have been extensively using the learning mode in order to teach the tool new gestures (Fig. 7). During their first encounters with the tool the children had showed their natural playfulness but after some time they got used to the tool and have been working with it without significant problems.

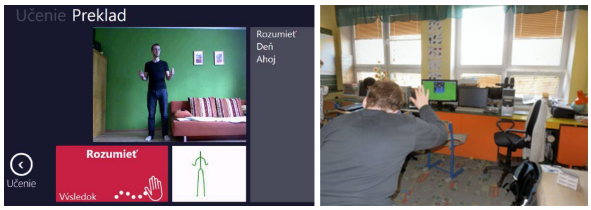

Figure 7. User interface of KPI-CGRS (left) and contactless gesture recognition in special pedagogy classroom

The practical experience showed that it will be suitable to alter some features of user interaction via MS Kinect. For example, the "push" movement, representing confirmation ("OK") when using MS Kinect, was hard to perform by some children. The configuration of the classroom where the system was tested also presented certain limitations. The first one light conditions were, which sometimes slow down the recognition process. The dimensions of the room were the second one. The first problem with the dimensions is that there has to be some distance between a person and the sensor. The second problem is that a presence of two or more children in the field of view of the sensor during the learning or translation can cause failure of the recognition process.

V. CONCLUSION

Technologies like virtual reality or mixed reality have the greatest progress nowadays. They allow the creation of previously impossible procedures. These procedures especially their visual aspect and interactivity may change streamline and shorten the process of interaction between humans and computers.

The benefits of KPI-CGRS software also lie in the practical utilization of available virtual reality equipment for gesture recognition processes. The advantage of the implemented sequence comparison method is in its capability to compare all forms of real-life sequences that can be represented in the form of vectors. The most significant disadvantage of its recognition process is that it only recognizes movements of arms and not of the fingers. This makes it unable to recognize gestures that differ only in the fingers positions. A second sensor is necessary to deal with this problem.

Working with handicapped children in our laboratory proved to be two-beneficial. The first benefit is the popular character, where children have a real experience with VR and the second benefit shows the research potential. Modifying user interface (KPI-CGRS, school-desk) and creating a new possibility of interaction (CAVE, HMD), opens up opportunities to work with handicapped children.

ACKNOWLEDGEMENT

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Focusing Software Engineering Education on Green Application Development

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Abstract - Mobile technology impacts our daily life in many significant ways. As more people become addicted on usage of such mobile devices in their need of unlimited access of recent news and industry-related information, the devices' uptime (battery life) and time needed for charging the batteries becomes an important issue. In fact, this uptime is most affected by the software being used by the people. Modern software engineering also addresses this problem by specially focusing testing on energy consumption and development on energy aware applications. In this paper, we present our approach to improve the knowledge of university graduates in this more expert topic to increase their competitiveness in the IT job market by focusing education on green software development. We intorduce new lectures and labs into existing subjects to inform our students on recent findings in this very topical domain. We also present measurements to evaluate the students' new skills and knowledge in this specific field.

I. INTRODUCTION

Computer networks, communication systems, data centers [5], huge production of mobile phones [4], and other IT infrastructures have caused severe environmental problems by consuming significant amounts of power [10], increasing greenhouse gas emissions, and lead to pollution during the production and disposal. To reduce such environmental problems and create a sustainable environment, new energy models, algorithms, methodologies, platforms, tools and systems are pressing. Thus, green computing and communications solutions should be designed with more renewable energy, higher energy efficiency, lower greenhouse gas emission, and less harmful materials.

By this paper, we present our university initiative to present a different point of view on software development. This point of view includes a focus on energy consumption of the product as well as the one of the production itself. As the presentation of important points of view cannot be ocassional, our solution includes a repetition rate to fix the related issues in the memory of the students and to present them various and mostly recent research practices to solve or avoid them.

We devide this paper into several sections. We start with Introduction and Motivation, then we present the history of the introduction of the focus point into our curricula at the Technical University of Košice (TUKE). Later, we also present our experiences from verbal student feedbacks from the examination period – more precisely from the exams of related subjects. As Conclusion, we present our future ideas on increasing the impact of the related materials on students' knowledge and practice.

II. RELATED WORK AND MOTIVATION

The software engineering and programming languages research [3] communities have developed advanced techniques to improve both programming productivity and program performance. For example, they developed powerful type and modular systems, model-driven software development approaches, integrated development environments that, indeed, improve programming productivity. These communities are also concerned with providing efficient execution models for such programs, by using compiler-specific optimizations (like, tail recursion elimination), incremental computation, and just-in-time compilation, for example. Most of those techniques aim at improving performance by reducing both execution time and memory consumption.

While in the previous century computer users were mainly looking for fast computer software, this is nowadays changing with the advent of powerful mobile devices, like laptops, tablets and smartphones. In our mobile-device age [7], one of the main computing bottlenecks is energy consumption [11,13]. In fact, mobile device

manufacturers and their users are as concerned with the performance of their device as in battery consumption/lifetime.

This growing concern on energy efficiency may also be associated with the perspective of software developers. Unfortunately, developing energy-aware software [9,12] is still a difficult task. While programming languages provide several compiler optimizations [17], memory profiler tools, benchmark and time execution monitoring frameworks, there are no equivalent tools and frameworks to profile/optimize energy consumption [14,15].

Ziliang Zong presented a talk [16] at the GREENS workshop at ICSE 2016 conference, where he stated that software developers benefit automatically from improving hardware energy efficiency without improving code energy efficiency. This trend will change as hardware is now approaching its physical limitation on further improving energy efficiency due to the transistor density wall, the heat wall, and the voltage scaling wall. The excessive power consumption of data centers and the ubiquitous usage of battery-driven devices require innovative research and creative practices in improving software energy efficiency. He (Mr. Zong) emphasized that *„green software design faces enormous challenges due to the lack of standards in software industry, in-depth research and mature theories, and easy-to-use tools that allow software developers write green code“*.

The goal of our research and teaching project is to propose the theoretical background for software energy measurement as a motivation tool for decreasing energy consumption caused by bad software solutions while implementing common requirements in generic and/or custom software development. This theoretical background includes metric definitions [6] and measurement techniques for measuring energy consumption of software as a whole and as of its parts. It does it in both meanings of measurement, i.e. by classical dynamic measurements by simulating the programs as well as by static code inspections [1,2,18,19].

We are developing and/or identifying metrics and methods for energy consumption in software. Besides that, we also design techniques and supporting tools to the developers that are more energy-aware. We do that by adopting and/or extending existing testware for white box testing (connecting internal metrics with energy consumption) and black box testing (to provide test cases for energy performance testing of applications).

In our methodology, we search for relations between energy consumption and specific lines of code of the software application. More precisely, we develop our methodology of abnormal energy consumption detection following the idea of connecting test cases [8] to lines of code (i.e. going from external metrics to the internal ones).

III. GREEN SOFTWARE ENGINEERING EDUCATION AT TUKE

Theoretical aspects of green software engineering started with the “Quality and Management of Software” (QaMS) subject in 2012 by Ladislav Samuelis. This start was very little and situated in the last year of Informatics Masters’ programme. The content was quite phylosophical by using the “how much Carbon-Dioxyde is produced by a single mouse-click?” question. This question was aimed to start the discussion at the lecture on the real amount of energy consumed until one realizes that selected click, through the possible number of such clicks until the mouse gets recycled.

The fact that the subject was situated in the last year of study implies that there was almost no possibility to check whether any student started to apply at least his own procedures to ensure green-ness or measure energy efficiency or energy consumption of his applications. The question of energy efficiency became a returning question at final thesis defenses where there was a mobile application as part of the thesis outputs. Unfortunately, in the major cases the answers included an excuse on too short time to measure. If one has no system, then one has to wait until the battery gets low, and then one can repeat after re-charging that battery. This non-systematic approach based on everyday usage of the applications pointed out that there has to be a change.

Since 2015/16, the subject got moved to the last year of Informatics Bachelors’ programme under a new sound title “Software Project Management”. The benefit is that we can follow up the growth of the students in terms of looking at energy efficiency of their software during their Master studies. The question did not change at the lecture. The slides undergo a small update: to emphasize the topic, it received its extra slide separated from other software performance questions. To continuously point out the importance of performance metrics during software development, in some points (mostly mentioning that one should not forget about validation and verification) there is a returning memo on green-ness of the solution. In

the future, there will appear a question on "how many energy did we consume until now?"

Since the same academic year (i.e. 2015/16) a new subject was founded for Informatics and Business Informatics Masters' students – "Evolution of Software Systems" (ESS) [20]. The subject can be selected by 1st and 2nd year students as well, only for the Winter term.

To increase students' focus, João Saraiva was invited to TUKE to present an invited lecture in the frame of the subject. The title of his presentation explains everything the students had to answer later at the exams: "Development and Evolution of Green Software"

The main goal of the ESS subject is to point out the importance of issues found during development and usage, especially their role in the software life cycle. For this aim, the students are providing several measurements of their own existing software solutions. Measurement results are then handled as requirements for improvements of their existing software. Besides static code analysis, the students execute blackbox and whitebox testing and evaluate usability as well. These initial values are then analyzed and the task for the student teams is to improve the software in terms of all measurements they realized before.

Energy efficiency evaluation is not yet part of the tasks, but our plan is to extend them that way. In 2016/17 there was a full lecture devoted to Green software engineering, which implied the exinstence of several questions at the exam as well.

In 2016/17 we introduced a change into another subject. This subject is entitled "Fundamentals of Software Engineering" and it is situated in the second semester of Informatics, Business Informatics and Intelligent Systems Bachelors' programmes at TUKE. As this subject is aimed to introduce the basic terms, we found the way of inclusion of Green software engineering in between the student essay topics. And that both in the uncovered and hidden way! The direct topic is "Green Software Engineering", the hidden one is "Complexity of Algorithms". The direct topic is obviously focusing on energy consumption and its effects mostly on usability of applications, while during the presentation and discussion of the big-O notation of complexity of algorithms there is a natural question whether one would rather use the space efficient or time efficient variant of an algorithm to save battery life of his mobile phone or tablet. Everyone would use the energy efficient one, obviously.

Besides the above mentioned subject with many students, we are also cooperating in the field of individual assignments such as diploma theses for Bachelors' and Master degree. This cooperation includes but is not limited to consultations ad reviews of these theses.

As the topic of energy efficiency is closely related to preformance measurements, it is a logical consequence that the related final thesis topics are focusing on selected programming techniques, platforms or types of application software. In some cases the students also need to provide external measurements, i.e. measuring the energy consumption from outside the mobile device the software is running on, which requires higher technical skills.

As material and background preparation, there were different thesis topics solved in the field of manual and automated testing since 2005/06. Focus on energy efficiency was introduced in 2015/16 by the thesis "Green Software Development for the Android Platform". The review was written by Marco Couto (University of Minho), he also attended the defense in Košice.

Based on the success, in 2015/16 we started two other final theses ending in 2016/17:

1. Green Software Development for Application Servers,
2. Green Software Development for the iOS Platform.

Our future plans already started their implementation this year with the following final thesis topics:

1. Measuring Energy Efficiency of Working Software for the Windows Operating System,
2. Host Operating System Selection Effects on Software Development,
3. Data Layer Implementation Decision Effects on Internal and External Software Product Metrics' Values,
4. Energy Consumption Profile for the Waterfall Model,
5. Energy Consumption Profile for Evolutionary Development of iOS Applications.

High quality theses with foreign reviewers gain higher interest even at the defense, which often leads to new member applications for running projects or new ideas for new project proposals and cooperations even between universities. We already received 3 new member applications

during 16 months of project implementation for our related project listed in the Acknowledgments section.

IV. EVALUATION

In this section we present the evaluation and typical student reaction on questions related to energy efficiency or green software development in general. We have to state that these results are available since 2013/14 only as we have no access to the exam notes of our late colleague Ladislav Samuelis.

Our evaluation starts with the students' feedback at exams. Here, the majority of the students did not declare any difficulties while preparing for the exams by the inclusion of the parts related to energy efficiency. But, as this implied a new group of questions as well, 9 of 170 students asked at the QaMS exam to skip that question, which means that 5.294% of students did not learn the new part of the lecture. This looks to be almost constant for the old and new subjects as well, as the result for MSP was 3.33% (5 of 150) and for ESS was 5.365% (11 of 205). Only 2 students of ESS declared after skipping the question that they were not attending the lecture and could not find the required information on the internet.

Students at the labs still tend to apply only easy metrics – software metrics built in their development tools. Energy efficiency in not the part of any such tool by now, so this aspect is not adressed by them. To change the situation, we decided to define the already mentioned diploma theses.

In the case of final theses, the influence of supervisor is relatively higher than the teachers' influence at specific subjects, but it is sometimes not enough for success. In acad. year 2016/17, one final thesis was not submitted, the other one was defeated without a problem from reviewer's of committee's side. Here, the reviewer was from Portugal, the thesis was submitted at TUKE in Slovakia. 50% success is low, especially if we see that the second work failed because of the activity of the student.

Ongoing theses show two important aspects:

1. The number of students interesting in the topics related to green software is increasing, which is an advantage even that there are still students applying to topics that are more than they can fulfill. To change that we need a much better preparation of students.
2. The language of diploma theses does not limit to English anymore, even that between the students solving the currently active thesis topics one can find besides Slovak students a Lybian student as well.

CONCLUSION

The procedures of introducing topical content into existing curricula are never too simple. One thing we encountered was the lower flexibility within selected subjects – the fundamental subjects are less flexible to introduce topical content, the almost only way seems to be to include larger practical examples focusing on main characteristics or limitations of such fundamental principles. Practical subjects offer more space to introduce energy efficiency related topics via short student essays, open lecture topics or practical tasks.

The most suitable software engineering subjects are related to testing, evolution and maintenance. Subjects presenting fundamental principles or focusing on design are less suitable due to the lack of personal experience of students with good or bad energy efficiency. As it is very uncommon in any software engineering curricula to start with the practical subjects, more precisely to teach testing before design, the subjects related to evolution and maintenance of software systems should be the ones where green software engineering becomes part of standard content.

How to improve the presented situation? There are many classical ways already presented above such as new or guest lectures, individual research essays, diploma theses and student programming tasks including the ones for software evolution. But, the real effect might be reached in a less typical way, namely by defining student programming contests such as a "The Greener The Better" mobile application coding battle. We will focus our future work so that we can provide all necessary conditions for realization of such contests, including a transparent cross-platform evaluation, and also to prepare student competitors for such coding battles.

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USE OF MODERN COMMUNICATION IN SCHOOLS IN SERBIA

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Abstract - Improving the quality of teaching, and therefore education in our school system is very common pursuit. The use of modern communication in teaching is one of the ways of improving education. In our schools, except in Informatic, use of computers in education is not as widespread as it is in the world. However, with the help of the ministry of investment, this trend is slowly changing and, in some schools, use of computers in teaching is enabled.

I. INTRODUCTION

In each country, science and education constitute an important factor of social development [1]. Striving for progres, education is an essential factor, which every nation must deal. Scientific and technological revolution that has swept Serbia caused changes in all areas of education. That had a significant impact on the development, programming and practical implementation of modern communication in our educational process.

Educational activity, whit the introduction of modern communication in education, occupies a more important place in society. The new concept of teaching in our schools has brought a big change in the theory and practice. The aim and objectives of education are significantly altered, the position of students and teachers in the classroom is changed, there is a novelty in the organization and therefore in technology of classes [2].

For Serbia, there is no exact research that could show the degree of use of modern communications in our schools, but the awareness of the necessity of their use is greatly present.

II. MODERN COMMUNICATIONS IN TEACHING AND THEIR ROLE

According to [3], an e-education is the teaching material that can be presented by the computer. Modern communications in education, Kan [4] is defined as a new approach to knowledge transfer to a remote audience, where the transmission of information is performed via the Internet. However, under the e-education is considered much more than a presentation or transfer of material via the Internet; e-education must be based on the student and the learning process.

The main goal of introducing ICT into teaching is to facilitate the concourse of knowledge to students and that duration of this knowledge is longer. Besides the financial possibilities of the school, the introduction depends on both teachers and students, respectively, depends of their willingness and capability to work with modern technology.

According to the research, teaching whit the use of ICT is more effective than the average lectures and up to 30 percent because the concentration of the students was kept at a high level [5]. This allows the potential of offering to students the complete knowledge, which is necessary in order to achieve high standards of learning in all areas.

Computer and communication technology in teaching are used for more than three decades. However, among theorists govern different opinions with regard to their role in education. According to Clark [6] technologies are only a means of transferring knowledge and they not affect student achievement. Although the results of the research show that students achieve better results with the use of audiovisual and computer media Clarke says that this is because of better learning strategies that are embedded in the multimedia instructional material. A similar opinion has Shram [7], which states that the learning depends on the structure of teaching and strategy of its implementation, not the kind of technology that is being transported.

In contrast, Kozma [8] considers the various possibilities of computers necessary for the representation of real models and simulations, therefore, aids also have an impact on the learning

process. However, the computer is not a motivator that encourages students to learn, it's the appropriate interaction of students with models and simulations that motivate the students. Therefore, they must be designed according to specific pedagogical, methodical and aesthetic principles.

Learning supported by the communication technology has many advantages [9], but it requires that the instructional material is conceived and distributed in accordance with the subject and the students, and it has to provide the grade technical quality.

III. IMPORTANCE OF INFORMATION-COMMUNICATION TECHNOLOGIES IN MODERN TEACHING

In recent years, it is notable that students are less interested and motivated to listen the classical school classes. There was a need for teachers to be not only computer literate, but also skillful in the use of modern technology. In order to be able to respond to the emerging needs of modern society, and to monitor students in the development, educators need to place scientific and technical knowledge adequately. To raise the quality of teaching to a higher level, to encourage participation of students in learning, allow an easier understanding of the material and to prolong the knowledge, teaching must be modernized by the information and communication technologies.

Knowledge and use of information and communication technology in the modern world is one of the basic elements of literacy and culture of people. There is no doubt that the use of computers greatly facilitates learning and working. Equipping schools with modern computer equipment and the computer literacy of teachers is one of the priorities of the reform of our educational system.

Training of personnel represents the best and most cost-effective investment for maximum utilization of human resources. Today dominant opinion is that the education, knowledge and human resources are on the very top priorities of the national strategies and policies, as well as social, economic, technological and cultural development. Also it is considered that they can not be replaced by other development factors.

Tremendous change in communication, education and market trends in nowadays are introduced on the Internet and its applications. These changes require "online spaces" whit much greater attention than ever before.

IV. E-DEVELOPMENT OF EDUCATION IN SERBIA

Regardless of financial capabilities and available infrastructure, education in Serbia is still characterized by certain dynamism, and the struggle to, as increasingly as possible, reach contemporary achievements in this area. Although this seems exaggerated when we talk about our education system as a whole, the fact is that there are some faculties, which in terms of research or method aren't far behind the most developed world centers. The point is that some colleges have already noticed the opportunities provided by new technologies, and without waiting for a national strategy, they begin with its introduction into teaching.

WUS (World University Service of Austria) launched a serious initiative for the development of e-education in Serbia, financing the projects for the establishment of university centers of e-education in all university centers in the country (Belgrade, Novi Sad, Nis and Kragujevac).

The concept of e-learning in the educational system of our country, is not intended to replace the entire traditional teaching, but it is there to expand and transform it, creating a new combination of learning "face to face" and the electronic interactions. New information technologies and learning paradigms will be directed at changing the traditional school system in terms of its improvement and expansion of additional content and forms of education. The main goal is for students to have access to information whenever they want.

We can expect the growing influence of ICT in the school system. However, whit their introduction, success will not come by itself, the most responsible for it will be school authority. They haw to put these systems into the function of the development for the school, otherwise, the system will only is a burden to demotivate students.

V. CONCEPT OF MODERN SCHOOLS IN SERBIA

The concept of education, which is still in use, is built in the 17th century by the great educator of Europe, Jan Amos Comenius. The role of the school is reflected in the fact that his work answers to the demands of the industrial revolution. Things have changed; the concept is outdated and needs to change. Now schools are required to keep pace with the demands of the information revolution and the needs of modern life.

Conditions contemporary school must provide to their students are far complex than they were

before. Teaching environment must be rich whit IC technologies, which will be available to students. The role of the teacher and his connection with students has been changed from the root. He now has to be a motivator, organizer and modeler of the classes while a student takes the role active participants.

All communications technologies must be placed in the learning function search the required information, learning how to learn, use of the information, implementing a variety of research methods and so on [10].

The essence of using computers in teaching and learning is in appropriate pragmatic, as technological support to teaching process, for the learning to achieve an appropriate and organized manner [11].

E-learning, in our county is usually carried out in a hybrid form, a part of the work is through the Internet, and another part of work is in the classroom in the presence of a teacher. At the same time we have the following problems [12]:

- to determine the degree of integration of distance learning and conventional learning, based on technical and psychological factors;
- to establish criteria for evaluating the effectiveness of e-learning;
- problems with the infrastructure;
- to maintain the motivation of students;
- to increase the activity of students and to establish permanent contact with the supervisor in person and over the Internet;
- to conceived design and availability of the system for e-learning in accordance with the age of students.

VI. NECESSITY OF PROFESSIONAL TRAINING TEACHERS FOR THE CONTEMPORARY INSTRUCTIONAL WORK

In modern teaching technology [13], it is hard to cope teachers who are university educated in the traditional way. Without sufficient pedagogical, psychological, didactic, methodical and IT education, there is not a modern teacher. Even during their studies they have to be trained to use computers and other modern technologies. Teachers who do not acquire these skills during their studies, they have to be further educated in modern teaching. Their professional training with the intention of training to use information and communication technologies in the teaching process, today it has become an essential factor in the modern education system [14].

To adopt innovative teaching models in teaching practice, initially by teachers, we must start from a radical changes from the very beginning, in other words we must establish an adequate system of teacher education during their studies at teacher training colleges, as well as their professional training and professional development during they work. Both of these segments include training them to use modern educational technology [15].

Trainings for teachers in our country are usually realized by attending mandatory seminars. They cover professional and pedagogical, methodical, technical and other areas that are important for the professional development of teachers. Every other year, is printed a special catalog with specific programs for professional training, whose authors are professionals, individuals and institutions in certain professions. The license for the program assigned by the Ministry of Education and Technological Development of Republic of Serbia and the Institute for the Advancement of Education. Work license renewal for teachers requires attending 120 hours of seminars and expert meetings. On them they share their experiences of school practice, which are very useful for self-reflection and self-identification.

Researches on the subject of professional training has showed that teachers prefer to professional development is a continuous process that will be available to all who wish to advance to attend professional seminars to cooperate with colleagues from the same profession that advisors provide greater professional assistance that organizes sample meter and all scientific and professional groups, to increase the co-operation with other schools, to improve the methods and forms of classes with the use of information and communication technology [16].

According to teachers, various forms of expert training aim to improve the methods and the forms of the teaching process. They wanted to referent on the application of information technology in teaching, on the active teaching where the main actors will be taught to conduct different types of workshops, building interpersonal and communication skills and others [17].

The changes are logical and necessary, but according to [18], our school is too "stable", and doesn't change according to social needs. School newspapers should be initiated, to the extent that its primary role is to educate, not fundamentally undermine. If changes don't start and strive to keep pace with changes in society, it can reduce its

influence, to the extent, that they themselves lead to abolition.

Today's students or "digital natives" as they called Mark Prenski [19], have drastically changed. They are not like those students that our educational system was designed for. Newer generation, from kindergarten to college, are growing up with the new technology. To them it is available at an early age. Internet, computers, e-mail, video cameras, mobile phones and other tools of the digital age have become an integral part of their lives. It is clear that as a result of this ubiquitous environment and the amount of interaction with it, today's pupils (students) think and process information on the elementary different way from their predecessors. These differences go much further and deeper than teachers assume or understand.

VII. CONCLUSION

Education in Serbia is facing the challenges of rapid reform and the demands of the developed environment. Learning supported technology has a great impact on the education and it will be an integral part of the future [20]. New technologies and the challenges that it brings with it, do not leave any room for possible delays in adapting the educational process to modern social changes.

At this point, the task of our education system is reflected in the reduction of the gap between the traditional implementation of teaching and teaching accompanied by information and communication technology. One of the prerequisites for improving the quality of education in Serbia is also increasing computer literacy of teachers, in order to be strong enough to hold of the upcoming changes.

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Advanced Ads Website

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Abstract – In this paper is presented website that help users to find or deploy ads that they want. The main goal is to provide easy and accessible website. Instead of posting ads on bilbords or random places, we offer more suitable and innovative way to do so. With one click of the mouse, this website is showing you wide specter of ads that are standing out with their variety of different categories unlike usual websites of this content.

I. INTRODUCTION

The **history of advertising** can be traced to ancient civilizations. Egyptians used papyrus to make sales messages and wall posters. In ancient China, the earliest advertising known was oral of bamboo flutes played to sell candy. Nowadays, advertising is one of themost efficiant way of selling things with mutual interest. Without it, many big companies wouldn't be where they are now. This is why great amount of money is invested in advertising. Some people, who have no money to invest in their advertising keep their ads on places that are not so visable, This is why our website will help them to post so wide specter of users would see it. In nearest future we are hoping that this website will bloom and break the monotony of current, modern and similar sets of the same content. Convenient for all ages, those who want to buy or find out something, this web site shows you the most important information right away in order to find stuff easier. Also, you are one call away from a direct contact with your advertiser with whom you would make a deal of mutual interest.

II. ADVERTISING TROUGHT HISTORY

In the United States around 1840, Volney B. Palmer set up the first advertising agencyin Philadelphia. In 1842 Palmer bought large amounts of space in various newspapers at a discounted rate then resold the space at higher rates to advertisers. The actual ad – the copy, layout, and artwork – was still prepared by the company wishing to advertise; in effect, Palmer was a space broker. The situation changed in the late 19th century when the advertising agency of N.W. Ayer & Son was founded in New York. It planned, created, and executed complete advertising campaigns for its customers. It created several memorable slogans for firms such as De Beers, AT&T and the U.S. Army.

Advertising the developing world was dominated by agencies in the imperial powers, especially from London and Paris. J. Walter Thompson became the first American agency to expand internationally with the opening of J. Walter Thompson London in 1899. It expanded across the globe, becoming one of the first American agencies in Egypt, South Africa and Asia. Much of the pressure to expand came from General Motors, which wanted to export its automobiles worldwide Ford turned to N.W. Ayer, which began its expansion in Europe and Latin America in the 1930s. The typical policy was to put an American manager in charge, and hire a staff drawn from locals who had a better understanding of the language and the culture. In 1941-42, however, Ayer closed its foreign offices and decided to concentrate on the American market. In 2011, spending on advertising reached $143 billion in the United States and $467 billion worldwide. Today, internationally, the largest („big four“) advertising conglomeratesare Interpublic, Omnicom, Publicis, and WPP.

III. MAKING THE PROJECT

For making this website we used these programming languages:

HTML is a computer language devised to allow website creation. These websites can then be viewed by anyone else connected to the Internet. It is constantly undergoing revision and evolution to meet the demands and requirements of the growing Internet audience under the direction of the W3C, the organisation charged with designing and maintaining the language.

Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a markup language. Although most often used to set the visual style of web pages and user interfaces written in HTML and XHTML, the language can be applied to any XML document, including plain XML, SVG and XUL, and is applicable to rendering in speech, or on other media. Along with HTML and JavaScript, CSS is a

cornerstone technology used by most web sites to create visually engaging webpages, user interfaces for web applications, and user interfaces for many mobile applications.

Bootstrap is the most popular HTML, CSS, and JS framework for developing responsive, mobile first projects on the web.

JavaScript is a programming language used to make web pages interactive. It runs on your visitor's computer and doesn't require constant downloads from your website. JavaScript is often used to create polls and quizzes. JavaScript support is built right into all the major web browsers, including Internet Explorer, Firefox and Safari. Provided that the visitors to your website are using web browsers that support JavaScript (most do) and have JavaScript enabled (it is by default), then your JavaScript will run when they visit the page.

jQuery is a lightweight, "write less, do more", JavaScript library. The purpose of jQuery is to make it much easier to use JavaScript on your website. jQuery takes a lot of common tasks that require many lines of JavaScript code to accomplish, and wraps them into methods that you can call with a single line of code. jQuery also simplifies a lot of the complicated things from JavaScript, like AJAX calls and DOM manipulation.

PHP is a server-side scripting language designed primarily for web development but also used as a general-purpose programming language. Originally created by Rasmus Lerdorf in 1994, the PHP reference implementation is now produced by The PHP Development Team. PHP originally stood for Personal Home Page, but it now stands for the recursive acronym PHP: Hypertext Preprocessor.

MySQL is an open-source relational database management system (RDBMS). Its name is a combination of "My", the name of co-founder Michael Widenius' daughter, and "SQL", the abbreviation for Structured Query Language. The MySQL development project has made its source code available under the terms of the GNU General Public License, as well as under a variety of proprietary agreements. MySQL was owned and sponsored by a single for-profit firm, the Swedish company MySQL AB, now owned by Oracle Corporation. For proprietary use, several paid editions are available, and offer additional functionality.

Object-oriented programming (OOP) is a programming paradigm based on the concept of "objects", which may contain data, in the form of fields, often known as attributes; and code, in the form of procedures, often known as methods. A feature of objects is that an object's procedures can access and often modify the data fields of the object with which they are associated (objects have a notion of "this" or "self"). In OOP, computer programs are designed by making them out of objects that interact with one another. [1][2] There is significant diversity of OOP languages, but the most popular ones are class-based, meaning that objects are instances of classes, which typically also determine their type.

IV. USING OF THE WEBSITE

Authors are focused on simplicity when it comes to design of this website. The navigate bar on the homepage includes:

- our label,
- o nama (about us),
- kategorije (categories),
- kontakt (contact),
- search bar,
- registracija (register) / Welcome user!
- Prijava (log in)/Odjavi se (log out)

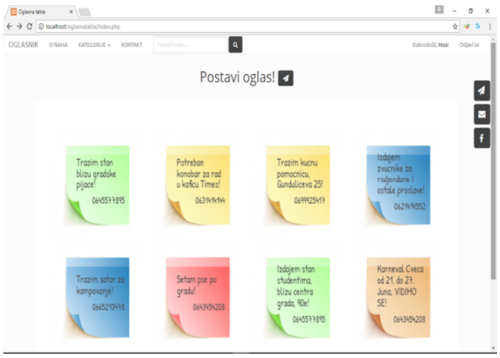

Figure 1. Home page

Registration is the first thing you need to get access to post ads. Required fields are:

- korisničko ime (username),
- e-mail,
- broj telefona (telephone number),
- lozinka (password),
- lozinka ponovo(password again)

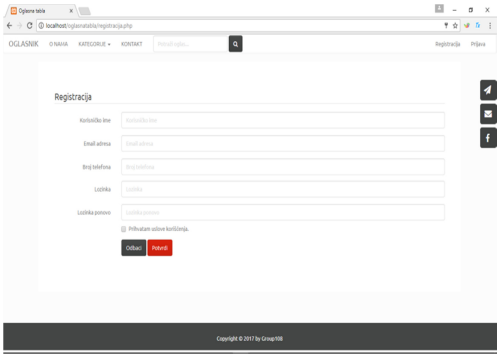

Figure 2. Registration page

After you have logged in, you have an option to post an add. You need to pick the category that you want to put ad in.

Categories:

- usluge (services),
- proizvodi (products),
- životnje (animals),
- dogadjaji (events),
- smeštaj (lodging),
- iznajmljivanje (rent),
- izgubljeno/nadjeno (lost/found)

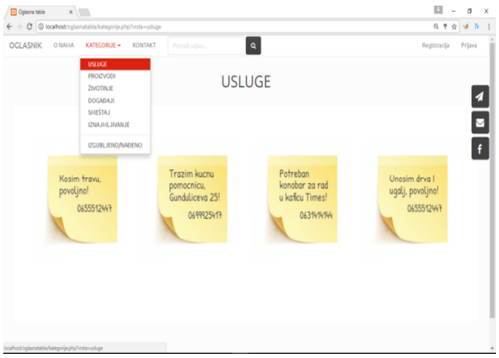

Figure 3. Categories

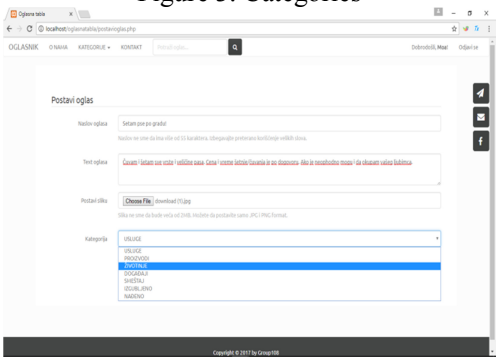

Figure 4. Posting an ad

Each category has its own color to represent it, colors go by this order:

- services – blue,
- products – yellow,
- animals – purple,
- events – orange,
- lodging – cyan,
- rent – brown,
- lost/found – red/green

After filling all the required fields, you can post an ad. It goes to your personal profile, and you can check it whenever you want.

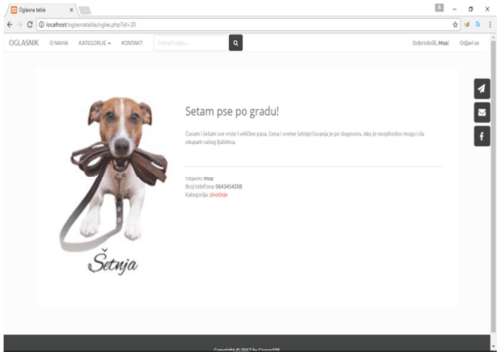

Figure 5. Ad

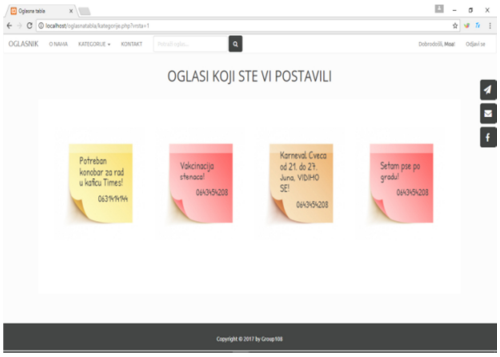

Figure 6. User's ads

After you have used you account you have an option to log out. That button brings you back to the homepage.

V. SUBLIME TEXT 3

Software we used for coding is Sublime Text 3.Version 3 entered beta on 29 January 2013. At first available only for registered users who have purchased Sublime Text 2, on 28 June 2013 it became available to the general public. However, the very latest development builds still require a registration code.Two of the main features that Sublime Text 3 adds include symbol indexing and pane management. Symbol Indexing allows Sublime Text to scan files and build an index to

facilitate the features Goto Definition and Goto Symbol in Project. Pane Management allows users to move between panes via hotkeys.

Sublime Text 3 is very stable, as of 22 March 2016, about 80% of those using Package Control are running version 3 and Sublime Text 3 is the default download version on its website.

VI. CONCLUSION

Soon, we won't see ads around the streets nor people putting them there, everything will be online with only one click, with less effort and time spent, but the maximum performance. We believe that with this site, we would help users to get in touch with the salesman or customer in a much easier and faster way, to do the shopping successfully and sell products. We assume that the site will attract people due to its design, but the simplicity is the reason they will fall in love with it.

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An Approach for Increasing Pupil's Motivation - Mathematical Tournament

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Abstract - Teacher's aspiration is to develop the internal need for systematic learning as a basic motivation for students. As a form of motivation, the authors have been studying the "Mathematical Tournament". This paper presents authors initiative and implementation of the "Mathematical Tournament".

I. INTRODUCTION

"The question of how to link learning and academic success with motivation, attitudes, interests, is the essence of pedagogical theory and practice in general" [1]. Every day, in teaching we face the problem of motivating students not only for work at school, but also the problem of how to motivate students to become interested in the subject. Learning in school is not an inherent individual characteristic of a student which he brings to school, but "the behaviour of teachers and the teaching characteristics, influence the development and further evolution of academic motivation " [2]. As it is known that not all students are equal, it is necessary for a teacher to know the individuality, the specificity of each student.

One of the most significant problems of contemporary teaching is how to motivate the unmotivated or insufficiently motivated learners to learn. "It became clear that learning success is not enough to be able (capable) to succeed, but it is necessary to desire it (be motivated) "[3]. It is emphasized in [4] that the most key factor of success is the engagement of all potentials and the capacity of the individuals. Everyday classroom experience shows that the students are not interested in the teaching contents and the activities we present to them. So, we are forced to deal with finding, on the daily basis, innovative ways of doing to make the teaching content more interesting, e.g. to motivate students to joyfully view teaching contents and willingly participate in all activities.

II. MOTIVATION

A. *Meaning of motivation*

The word motivation is derived from the Latin verb movere which means to move. So, the motivation must be understood as a process that is constantly changing (moving). Motivation is a force that drives students to cognition, learning, discovering new teaching contents. That is why motivation is very important in the education process. It is clear that each individual's motivation influences the extent to which they will be involved in the teaching process, as well as how much they will have the desire, and will, to deepen the teaching content, expand their knowledge and how they will react when they encounter an obstacle. Many psychologists and pedagogues have studied motivation. Theory of motivation deals with both, the internal and external motivation. As the name suggests external motivation depends not only on students but is determined by the external environment, as well as standards that are present in an environment in which students live and the status of students in the work environment, as well.

B. *Foundations of motivation*

High quality motivation is harmonized with theories of needs and cognitive theory. Theories of needs focus on different necessities [5]:

- the theory of instincts,
- the theory of social needs,
- Maslovljev's hierarchy of needs (self-actualization is the highest level, that can be reached from the basic physiological needs through the following needs for security, for belonging and love and for being respected),
- the theory of conditionalities.

Cognitive theory collects: the theory of cognitive balance, the theory of expectations, attribution theory and the theory of social cognition

[6]. Particularly, the Festinger theory of cognitive dissonance and Heider's balance theory claim that the essence of the motivation lies in establishing cognitive balance. The most important representative of cognitive motivation is George Kelly. He argues that every man is by nature "a scientist" who tries to, predict in their own way, different phenomena [6].

III. MOTIVATING STUDENTS

The most important question in a teaching process in general is how to motivate students?

It is known that there are two types of motivators: internal and external. Internal motivators are the sense of achievement and responsibility. They arise from internal desire for knowledge. Students learn because they need to learn, discover, feel pleasure in learning and achieving learning goals they have set for themselves. There is no external reason for students to learn. When there is an external motivation, that is an award, or a praise, it comes from the outside or the students' environment, and it is controlled by another. Every individual responds stronger to one or another group of motivators depending on the individual.

V. MATHEMATICAL TOURNAMENT

Each of us, teachers, has different approach and a way to motivate students in his or her classroom. A few years ago, we came up with the idea to organize a Mathematical tournament as a form of student motivation.

The Tournament was organized in the period from November to May and lasted 20 weeks. The week prior to quarter and half-year assessment was excluded. Every Thursday the teachers would put two tasks on the notice board and the school website (one for younger students and the other for older students). Students had until the following Thursday morning to finish their tasks and put the solved problems in the box placed under the notice board with the tasks, or they could send them by e-mail to an address written on the board and posted on the school website. On the following Thursday, a week after putting the mathematical problems on the board and the school website, the correct solution was posted, and another problem given for students to solve. Slips with solutions were removed from the box, and the solutions received by an e-mail were then reviewed and corrected and the students' score was recorded in a table. The winner was the student with the largest number of correctly solved tasks. After 5th task, current success list was posted so the students could follow their progress. Students were under no obligation to participate every week. Mathematical problems that were selected were logical and combinatorial, detective, counting, tasks with matches, magic squares etc. The idea was to develop interest in the students of our school and awake their curiosity for solving "interesting" tasks.

"Students are more willing and more focused when dealing with the activities they enjoy and which are interesting to them and which intrigue them spontaneously not only during classes, but also outside of school" [3].

A lot of students, from our school, and the students from other schools who found the online notice, took part in "mathematical tournament" in its first year. Over the years, the number of students increased, and now it has reached the quarter of the total number of students of our school. From the very first day we have noticed the increased interest of the students for solving tasks, finding the most elegant solution and mathematically correct solution explanation. The students eagerly awaited the next assignment and they even consulted each other about the correct solutions. Mathematical problems used for the tournament were collected from the collections of problems for additional work, from "Matematički list "or from other materials for young mathematicians.

In further, we present some of the posted problems:

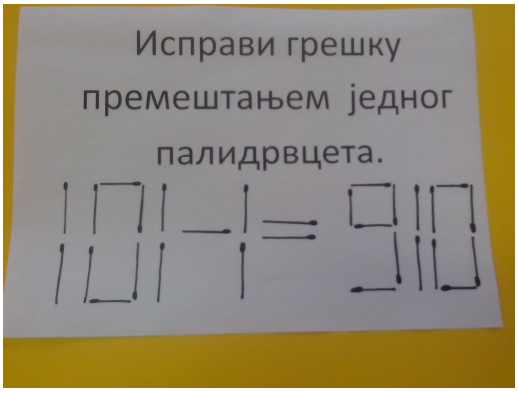

Figure 1. Correct the equation, by moving a match.

Figure 1. shows the most popular problem for younger students, namely, the largest number of students tried to solve it. They invested a lot of effort, but there were the least correct solutions. The problem is out of the curriculums, it develops children's imagination and ideas.

The young students were the most succesful in the problem presented in Figure 2. A complex problem (a system of equations with four unknowns) is easy for visualizization and solving, by imaging a real situation (e.g. in a market).

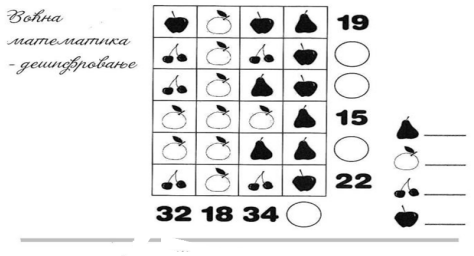

Figure 2. Fruit mathematics, decoding.

An example of the problems for older students is in Figure 3. The problem was the most successfully solved, the solutions are in Figure 4.

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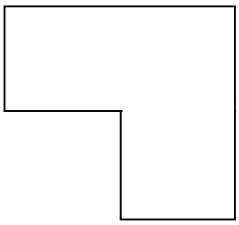

Figure 3. Divide the shape into 2 (4) equal pieces.

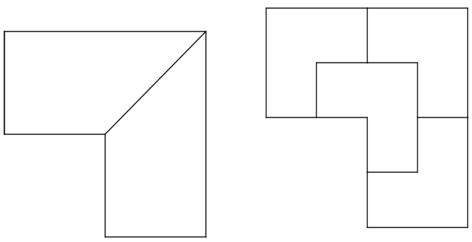

Figure 4. Students' solution

Although the two solutions are not related, the first one (which is easy to gain) encourages students not to give up of the second, significantly complex problem.

The hardest problem (the least correct solutions) for older students was closely related to a real life situation, but the solving implies high ability of decomposing problems, or knowing the Dirichle Principle. The problem follows:

- There are 12 boats on a lake, red ones with 3 seats and blue ones with 4 seats. How many red and blue boats are on the lake if there are 43 tourists in boats and all seats are occupied?

Open sessions with all interested participants were organized during the Mathematical tournament, after each 5 tasks, where the problems were discussed and the solutions were analyzed.

Based upon the students achievements, the following facts on students capabilities were imposed:

- good space perception,
- weak logical reasoning,
- weak correlation of mathematics with other subjects as well as with real life,
- lack of self-confidence, even when the knowledge is evident.

The extracted mathematical tournament results are:

- younger students correctly solve 75% of problems related to real life (the most succes), and only 15% of the problems that require abstract thinking;
- older students are the most successful in problems applicable in real life 70%, and they are the least successful in solving logical-combinatorial tasks 10%

VI. CONCLUSION

In the very first year of "Mathematics Tournament" it was obvious that the students showed greater interest in mathematics classes. They showed a greater desire for solving mathematical problems during regular classes although those participating in the tournament were not given problems used in regular classes.

Also, in these few years of existence of the "Mathematics tournament" an increase in children who take part in mathematical competitions, as well as in competition called "Kengur" and "Misliša" has been noted.

From the students' parents, we learned that students discuss tournament tasks and problems at home with their families.

With this tournament we have taken the correct path in motivating students to take interest in mathematics.

The most important fact is the lasting of the mathematical tournament throughout the school

year. In such a way, students are permanently called to deal with mathematics and to solve a problem not instantly (you know or you do not know), but to explore solution within a few days, even by discussions.

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Motivation as an Incentive for Students to Achieve Better Results With the use of Modern Technology

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Abstract - Motivation can be seen through the theory of achievement of objectives. Students first need an emotional boost to the successful implementation of tasks in school. The goals set by themselves during their education must be one of the main motivators. Students must have certain expectations of where effort brings results. Motivation is essential to achieve individual success. The future brings increasing development in the IT sector, which is why it becomes very important to encourage students not in these fields. At moments it is necessary to develop a positive and motivational atmosphere. The main factor in school success stems from the motivation of the students themselves by teachers. Research conducted on the representation of motivational elements in teaching in schools in the territory of the South and Middle Banat was carried out in order to find the best possible solutions for improving school achievement of primary school students.

I. INTRODUCTION

Motivation the segment represents our interests. The focus needs to be put on Commitment to reach a certain goal. In students, the motivation can be seen through a number of different factors that have an impact on the determination. Scientist John Keller, who has spent years studying the motivation of students as well as conditions that affect the same incentives, established the four categories, in which, based motivations. Motivation is essential can be seen through: (attention, relevance, confidence, satisfaction) [1]. The term motivation is to a great extent by using abstract categories Highlights I explain individual components or aspects to many different Processing during life that summarize our behavior. Application of interactive whiteboard allows Creative Learning encourages students to create dynamic presentations, includes a large number of innovations present in the classroom. Using the electronic blackboard in the classroom increases the quality of teaching content for themselves. Interactive table have a different set of characteristics allows the use of software applications, educational software, Displays various video content, play a combination of pictures I sound text and creating various types of documents. Its application gives possibility to visualize Therefore helps students to more quickly I easily understand a certain number of Information. In modern times summarize quality is one of the most important conditions of the economy, cultural, social and individual progress [2]. Quantitative expansion of education in the previous period of our development, must give adequate space standardization quality education based on world achievements of educators and psychologists in theory and practice. Pleasure is a key element of motivation success is reflected in a sufficient motivation of the people which is the main key and the width of the progress. Students who are motivated to actively and adequately more energetic perform academic tasks. At check knowledge these students achieve outstanding results. "The art of selecting people is not nearly as difficult art to enable selected to develop their full potential" (Napoleon Bonaparte). When motivating students is necessary first of all to be guided by moral values [3]. According to some views, should represent and understanding of standards in people about their duties and responsibilities, respect and treating others, the community, even to himself. "Scientists believe that necessary create a modern education system. Today necessary foundation based on developing IT technologies in education. It also is necessary that the school is available for all children in the world, regardless of their differences. Pupils and the teachers were necessary to give different incentives through motivational elements of a theory based on practice [4].

II. THE SUBJECT OF THE RESEARCH PROBLEM

One of the basic problems of teachers of the 21st century is to create motivation among

students and achieve a good incentive for achieving the best possible results found. At moments it is necessary to develop a positive and motivational atmosphere. Focus is necessary to put on the teacher as motivator, instead of the student as someone who stays motivated [5]. The main factor in school success stems from the motivation of the students themselves by teacher. Readiness that an effort be made to the school is just as important as learning strategies [6]. In our increasingly present insufficient motivation of students resulting in poor results at the end of the school years. Also one of the problems referred to are very poor ratings when tested at the final examination and poor qualifications and ranking when tested by the educational institution involved in. Due to these facts stands out as the main problem is the lack of conducted research related to the topic of motivation of students to the lack of necessary information on the representation of motivational school years related to the use of modern technology in teaching present on the territory of South and Central Banat.

III. THE AIM OF THE RESEARCH

Researched conducted on the representation of motivational elements in teaching in schools on the territory of South and Central Banat was performed in order to find the best possible solutions for improving the academic achievement of elementary school students. It is necessary to improve the existing methods to encourage colleagues to the introduction of modern technologies in the teaching process. We believe that this research can raise overall awareness among teachers on the application of technology in the future implementation of the teaching program. Therefore the development of motivational elements in class develops students' communication skills, freedom of thinking, encourage innovative ideas, the idea of mutual creativity. Exchange conditioned team spirit and teamwork as the basis for achieving the best possible results on the written and oral knowledge tests. Bell 1993 through research defined six primary factors affecting the acceptance of the engagement team and they are: personal characteristics, mental ability, current values, experience and learning [7]. It is therefore essential that students in smaller age motivated to participate in teamwork with the use of contemporary technologies in order to achieve better results during the class.

IV. RESEARCH HYPOTHESES

The main hypothesis: There is a correlation between age students and their attitudes toward motivational elements of in educational processes

Hypothesis 1. The largest number of respondents said that they use of modern technology in class encourages independent thinking, tasks, thus achieving the highest possible success.

Hypothesis 2. The majority of respondents believe that the diversity of the use of modern technology are increasing the dynamics present in the classes, and therefore encourages pupils to increased activity at a time resulting in better success in the knowledge test.

Hypothesis 3. The majority of the respondents considered that independently create current time with the support of modern teaching aids and subject teachers encourage students to better knowledge and skills.

V. AREA AND METHOD OF RESEARCH

Researched outputs have been held on the territory of South and Central Banat included a survey of students of higher and lower grades of primary schools in the area. Data was collected by a questionnaire in which it was pointed out that the survey is anonymous and the results will be used exclusively for research. The number of respondents is 120. Respondents were divided into two groups. One group consisted of students in lower grades, while the second group consisted of students in higher grades. Applied survey contains questions related to the motivational elements present in the classroom. The views of respondents are estimated using a Likert scale. Applied scale represents a five-point scale, with which respondents expressed their level of agreement or disagreement. The scale includes the following statements: Strongly disagree - 1 Disagree - 2, hesitant I - 3, I agree - 4, strongly agree - 5. Based on the data analysis was performed using Microsoft Excel.

VI. RESEARCH RESULTS

Students are considered to be most encouraged to motivate them the most affirmative moments in time. Research has shown that students' necessary to meet the emotional satisfaction of the achieved results. It takes hours to create a system of reward and punishment during lectures. Respondents great importance to give praise emphasize their value, which is the main incentive for achieving success. Praise over the activities of students in classes until achieved remarkable results at numerous competitions. There is the need to encourage creativity in order to realize innovative ideas with the help of modern technology. Most students believe that their presence helps a lot of modern

technology and encourages independent work with the thinking during lectures. Creative presentation of teaching chapters give students opportunities in an innovative way to demonstrate their abilities. Teaching units presented to students in the form of a short video or within the multimedia content becomes much more understandable to students as seen through the achieved results on the end of a particular chapter. The survey confirmed the initial hypothesis. For students of the first cycle of education is the biggest motivation praise from teachers for them the most important affirmative moments in class following an emotionally rewarding. While students of second cycle education considered their greatest reward and motivational factor for the high score in the diary. It also confirms the assumption of research that the majority of respondents reported that they use of modern technology in class encourages independent thinking, tasks, thus achieving the highest possible success and a better acquisition of knowledge and skills.

TABLE 1. Sample structure according to the achieved success in school

The success of students	Representation
Enough	**4%**
Good	**8%**
Very good	**20%**
Excellent	**68%**

TABLE 2. Age structure of pupils in primary school

Age limi	Representation
6-9 years. (Pupils in lower grades)	52%
from 10-14 years. (Upper Level)	48%

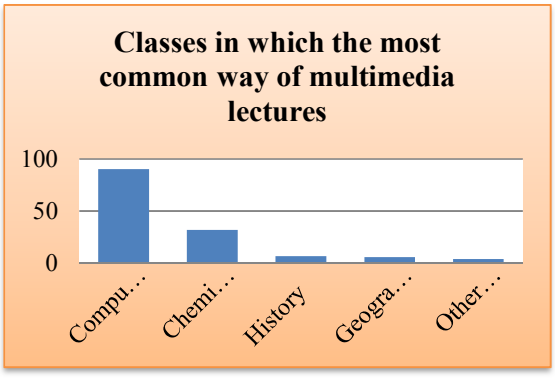

Figure 1. Multimedia way of teaching representation in class

Students point out that most multimedia content represented in the classes of information and technical education more than 90% of respondents gave a positive answer to the teachers of this course have made great efforts with creativity and innovation to these classes students were more interesting and educational at the same time. Followed by classes of chemistry, history and geography in which multimedia contents are also very present.

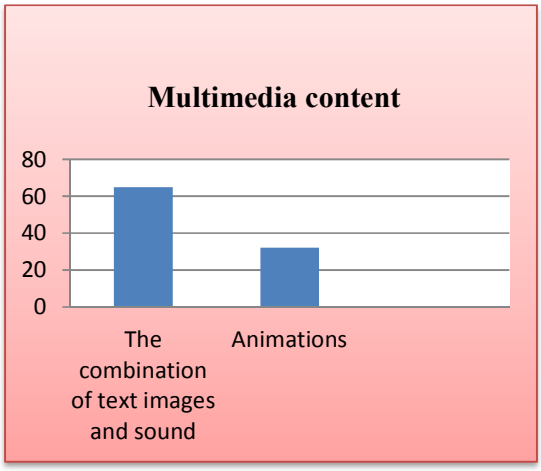

Figure 2. The most common type of multimedia content

Students in the course of the survey show them the diversity of content during the lectures can be encouraged to achieve better results. Multimedia content in them is a sense of creativity, innovation and a greater commitment to the lectures. They point out that the most common combination of sound image and text in the form of a presentation, also present different animations in the classes as well as lectures in the form of video content.

Students point out that the electronic textbooks are largely available for learning at home. Teachers in class during lectures using this type of content, however, do not have enough time to cover in this way and to move all the units (Figure 3.).

On the territory of South and Central Banat most school institution has more than one interactive whiteboard. Students point out that its receives and sets very little present, mainly in special cabinets while presenting a teaching unit. Like this type of teaching is not present every day in class. It is mostly represented in lower grade classes is the first cycle of education (Figure 4.). Figure 5. represent of creating multimedia content

Students pointed out that teachers are encouraged to work independently to create multimedia content necessary for the implementation of teaching units. Through various presentations motivate students to join the

implementation time. Over 60% of respondents gave a positive answer are considered to be sufficiently teachers motivate and encourage activity in class. Most students said they were most teachers motivate through the reward system mark. Most creative ideas students to create multimedia content teachers would generally rewarded with praise possibility presenting the same, and for the best high score follows that in most cases the best stimulant. (Figure 5.).

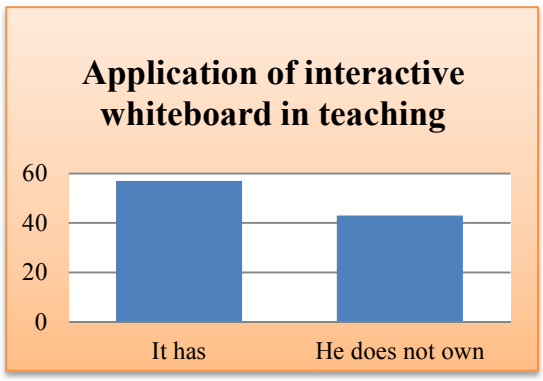

Figure 4. Application of interactive whiteboard in the classroom

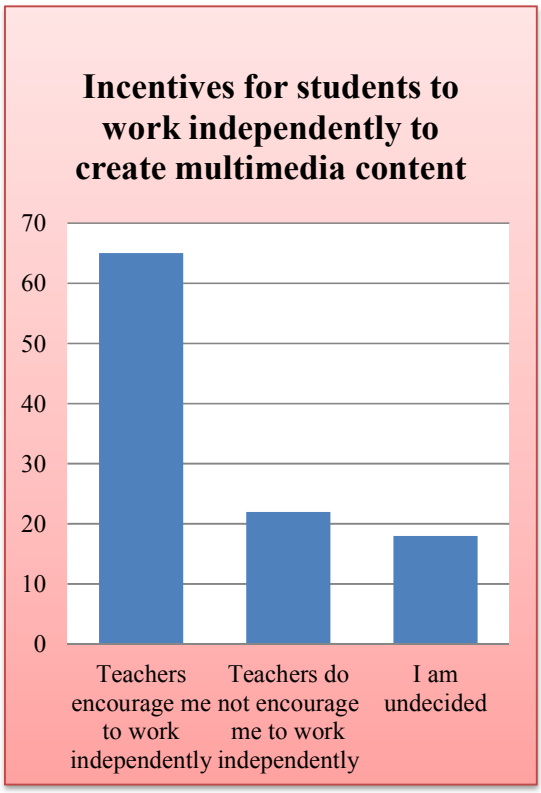

Figure 5. Representation of creating multimedia content

VII. CONCLUSION

Motivation as a process must be considered in the future. When we talk about students' motivation should be taken at their actual expectations of their goals and desires their interest. It is necessary to look at their needs whether related to the need for affiliation for creating new friendships or relating to personal success of students. The teacher must be viewed intrinsic motivation of students and the satisfaction of emotional needs and only later on the need for a high grade. The combination of different teaching strategies can to create motivational atmosphere in the class. Research has shown that students' necessary to meet the emotional satisfaction of the achieved results. It takes hours to create a system of reward and punishment during lectures. Respondents great importance to give praise emphasize their value, which is the main incentive for achieving success. Praise over the activities of students in classes until achieved remarkable results at numerous competitions. There is the need to encourage creativity in order to realize innovative ideas with the help of modern technology. Most students believe that their presence helps a lot of modern technology and encourages independent work with the thinking during lectures. Creative presentation of teaching chapters give students opportunities in an innovative way to demonstrate their abilities. Because of all these facts, it is necessary to focus motivational factors in the sectors of IT technology and what are the schools of the future and of the new century.

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A Method for Increasing the Level of Knowledge in Mathematics

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Abstract – One of the priorities of the European education and the education in our country is to increase the level of students' knowledge in mathematics. Students are using computers and mobile devices for personal needs, daily. If we can to encourage the students to use these electronic devices and software for: testing, research, visualization and solving real problems, we will receive students who are motivated to learn mathematics, and thus an increased level of their knowledge in mathematics. For this purpose, is constructed a website http://mathlabyrinth.azurewebsites.net. The problems placed on the website are in accordance with the subjects that are studying in secondary education and related to everyday situations with which the students are faced every day. These problems require knowledge in mathematics for their solving.

I. INTRODUCTION

In a recent several researches in our country and wider, it is determined that the students' knowledge in mathematics are decreased and are below the lower sill of knowledge. Because of that, one of the priorities of the European Union and our country in education is to increase the level of mathematics knowledge for the students in all ages. The students use computers, smart phones and other electronic devices more and more for their needs. It is needed to take this opportunity and to include this in the process of education for learning mathematics.

The free software (Geogebra) is using in the process of teaching mathematics, especially when is solving and visualizing constructive problems [1], problems with functions, problems in planimetry and solid geometry. By using of the software Classmarker, are made electronic tests for determining the students' achievements, [2] and which are great accepted by the students.

But, ICT is not enough exploited in the process of teaching mathematics. It is needed more use of ICT using in order to enlarge the level of knowledge. It is made research about the motivation of students in the high school "Koco Racin" in Veles, Macedonia and about the problems with which the students faced out in the process of solving mathematical problems. In the survey 145 students take a part. The accent in this questionnaire is put on the mathematical problems which refer to real-life problems. The researching is realized in order to determine whether the solving of these tasks will increase the motivation of students to learn mathematics and to determine the difficultness in the process of solving mathematical problems in the school classes and when the students write their homework, [3].

The question "Do you think that solving practical problems can increase the motivation for learning mathematics," 66% of the respondents said that that motivated them to learn math.

TABLE I.

The question "When you have problems in dealing with your homework, would like to have a website that will give the steps and help to solve the problems," 86% of the asked students said that they want, and only 5% said they do not want to have such help.

TABLE II.

For that purpose, is constructed the website http://mathlabyrinth.azurewebsites.net, [4] on which are presented problems and tasks related to real-life problems, methods and procedure for their solving and visualization. The website is using in the teaching process on classes and when students write their homework.

II. METHODODOLOGY OF THE WEBSITE' PROBLEMS PREPARATION

Before starting with the website' preparation, it was necessary to choose problems, tasks and process for their solving.

The greater number of the problems which are posted on the website, are derived from the books and collection with tasks. The problems and tasks are grouped in themes, that are studied in the secondary schools in Macedonia (figure 1).

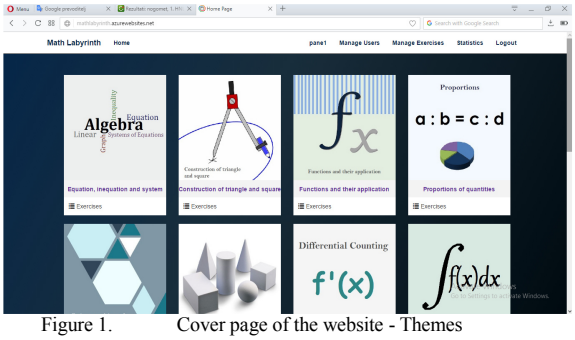


Figure 1. Cover page of the website - Themes

In determining the procedure for solving the tasks, knowing that they will be solved in the classes and in the homes, has been used a procedure based on Pólya represented in the book "How to resolve" [5].

The procedure is based on four principles:

- Understanding the problem;
- Plan for solving;
- Realization of the plan;
- Considering the solving process and the solution of the problem. How we can improve them?

The first principle "Understanding of the problem" is neglected very often, because the teachers think that it is obvious. Even this is not mentioned in many mathematical classes. Although, the students usually have difficulties when they are trying to solve the problem alone, because they don't understand the requirements in the task. In order to correct this point of view, Pólya gives instructions for teachers. The main aim of these instructions is to encourage the students to ask some questions themselves. The questions are in the forms: What is needed to be found? Could you tell yourself the problem with your own words? Could you draw a picture or diagram to help you for problem' understanding? Do you understand all words and terms in the problem?

At the beginning of the task, which will be placed on the website, the teacher will choose a several questions with the appropriate level of difficulty depending on the age of the students. So, they will easily understand the task and they will know how to solve it and what they should to calculate.

The second principle: make a plan: According to Pólya it is mentioned that there are existing many rational ways for problems' solving. Skill of choosing the appropriate strategy is learned by solving of many problems. So, this could be stressed to the students. A partial list of strategies: guess and check, eliminating the possibilities, use symmetry, consider the exceptional cases, use direct thinking, solving equations.

A specific list of strategies: search model, draw a picture, use a formula, be creative, use skills and etc.

When the plan and procedure for solving of the problem are chosen, usually are used free software for visualizing problems and represented a variety of actions to address them. Always is mentioned that this is one of the procedures to solve the problem. Creativity of the students can solve the problem in another way, or much faster.

The third principle: Implementing of the plan.

This step is usually easier than the step when plan is considering and analyzing. In general, all you need is patience and care, given that they have the required skills to continue with the plan that is selected. The author notes for this step: If the plan does not work, discard it and choose another plan. Do not be misled; this is the principle how mathematics is done, even by professionals.

In this part, the teacher is describing in details the steps for calculation of the problem' solution. He encourages the students that with this

procedure, they could solve the problem. But if they try to solve the problem in another way and it is not successful, that they should throw that plan and to try with new.

The fourth principle: Review / Extension

Pólya mentioned that much can be gained by taking time to reflect and look back at what you have done, and what not. It will allow you to predict what strategy should be used to solve problems in the future, if they were applied to the original problem.

Finally, the teacher congratulated for a job well done and encouraged to use these principles and to solve other problems. If the students have a new solution, they should to send it to the teacher and the same can be published and shared with other students.

III. IMPLEMENTATION OF TASKS

Using these rules, the results of the surveys are made a web page "Mathematical Labyrinth", which contains textual tasks related to real life [4].

For every task posted on the website, the first preparation was made using the principles of Pole and the instructions obtained from the survey. (Figure 2)

area/topic/subject – **Differential counting**

Problem - 9

A sewage channel is supposed to be built along a road by connecting three 1m wide cement blocks. The cross section of the channel is an isosceles trapezium with smaller base and equal to the side. Under what angle in relation to the base should the blocks be set to get largest channel with biggest section (the biggest permeability?)

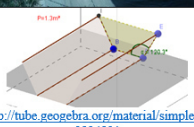
Steps/Stages	Help/hints	Answer/solution
How does a sewage channel look like?	(Search for images)	
Make a 3D sketch of a sewage channel	A sketch in GeoGebra with flexible spot	 http://tube.geogebra.org/material/simple/id/2824831
Mark the angle with α (the one with which you can change the walls of the channel)	Make a movable point to change the position of the channel walls.	Observe the position of the walls
What figure did you get?	Straighten up the figure	Prism with a isosceles trapezium

Figure 2. An example of a ready task

By logging into the website as an administrator (teacher) you can set tasks. The main menu contains Math Labyrinth-Home, Manager Users, Manager Exercises and Statistics.

Method of setting tasks.

By selecting the Manager Exercises window, the fields in which the task is to be entered are opened.

In the Exercise Description field, the task test is entered, in the Exercise Name field, the title of the task is entered, and in the Exercise Topic field, the topic from which the task is selected is selected from the drop down menu. (Figure 3)

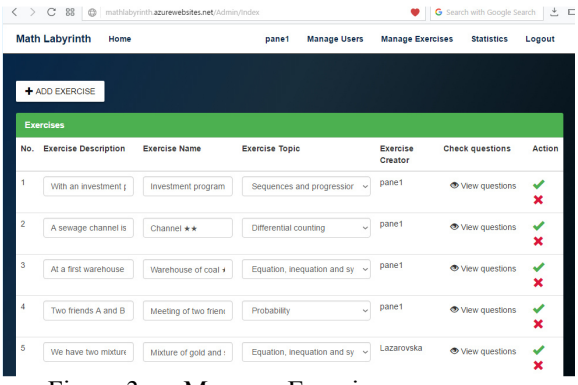


Figure 3. Manager Exercises

By clicking View question, go to the next window where Questions, Help, Answer, and Additional are written. In either field, you can type text or file with the choice of one of the Add / Edit text buttons or Add / Edit file. In the Question field the question is written, in Latex. In Help, some help is added to the question to get to the answer. Answer answers the question, image, or link to an applet associated with the answer. In Additional, additional information about the applet's construction, the construction of the image, or some other additional information that the student can use in solving the tasks will be added. (Figure 4)

In the Orderin Flow field, the row number of the question is selected and finally recorded.

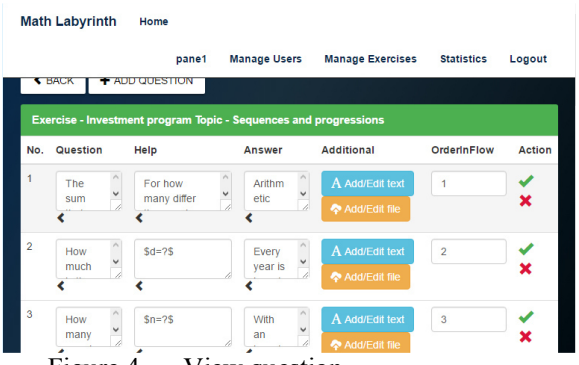


Figure 4. View question

After entering all the questions and the answer we return to the home page and record the entire task again.

In this way, all the tasks on the website are set.

How to use the student web site?

By logging into the website as a student, the assigned tasks can be used. The main menu contains: MathLabyrinth Home and Logout. (Figure 5)

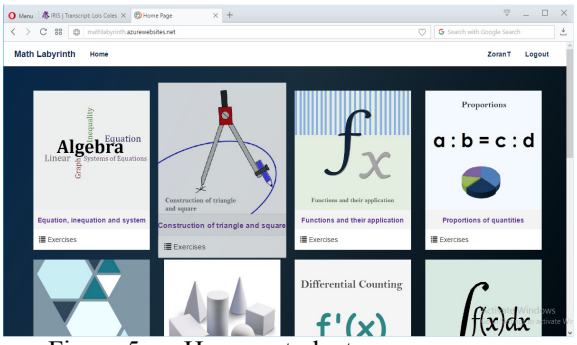


Figure 5. Home - student

All topics are set in Home. By choosing the theme, go to the tasks that are set by that topic. Can read headlines and their contents. If she wants to solve a task and see what her solution is, click on the Play button to start the task, start with the "game" in Math Labyrinth. The resolution steps are set in the form of a maze, so the entire application is called the Mathematical Labyrinth. Clicking on the Play button starts the procedure for solving the task. First, a window opens in which the principles of Pole are written, and then the mode of operation of the task is selected: Test mode - if it only wants to use the questions and help to come to the solution of the task, i.e. Just to test whether a solution or Practice mode can come up - if it wants to use the questions, help, and answers to each question, which will come to the solution of the task. (Figure 6)

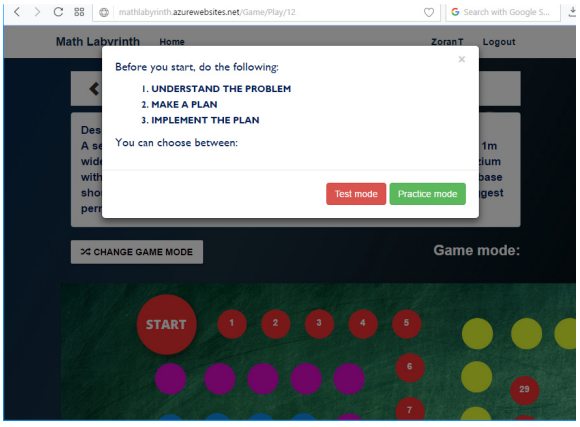


Figure 6. Test mode and Practice mode

By selecting one of the mode to solve the task, a window is displayed showing the maze and by clicking on the number 1 button, the procedure for presenting the task begins. (Figure 7)

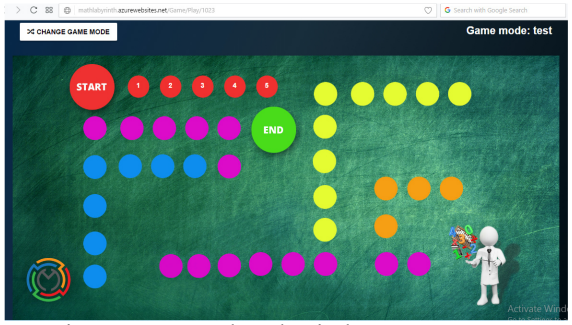


Figure 7. Math Labyrinth

Each step has one question that the student should answer, an image or a link to the applet to which the student should go in order to see the visualization of the task or the decision. (Figure 8)

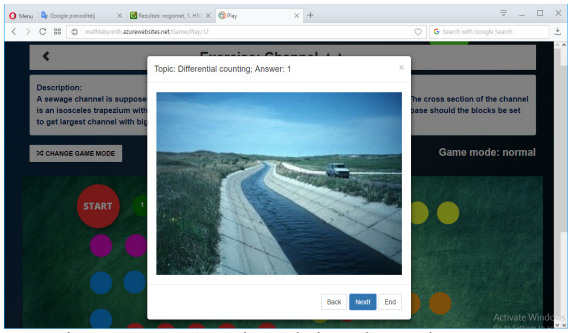


Figure 8. Step in solving the task

By completing the procedure for solving the assignment, the student receives the solution and a window on which a note is congratulated for his persistence. In doing so, it encourages the student to try to independently solve other tasks.

IV. APPLICATION OF THE WEB SITE

If we are logged in as Super Admin, in the Statistics tab we can see how many users on the page have registered, how many of them are students, and how many teachers.

During the testing period, this website has had 20 teachers and everyone has a positive opinion about it. About the way of assigning tasks and using the website.

So far, 110 students from the Schools who are involved in the testing of this website have been registered.

The teacher can see which students have used this page so far, how long they have been on the site and what tasks they have fully solved.

All students have positive results so far.

By completing the testing period of the website, another survey will be prepared in order to

determine the student's level of knowledge after using these tasks and the motivation for learning mathematics.

V. CONCLUSION

By using the website, using IT in mathematics teaching, when solving tasks and visualizing them, we will increase the motivation of students in mathematics learning.

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Big data analysis and application of experimental research in the higher education process

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Abstract - This paper provides an experimental approach to express a simple and engaging framework for familiarizing students with the process of quality and quantity management in engineering research. In this article, it's illustrated how experiments can be used in the classroom environment by describing a module that is implemented in high educational classrooms. The module familiarized students with how the scientific methods and mathematical methods can be applied to scientific questions and introduced them to basic mathematical concepts for resolving a technical, economical or other social issues. This specific paper can serve as a model for how more complex and rigorous experimental designs can be used to actively engage more advanced (high educational-level) students in the process of research design and statistical analysis.

I. INTRODUCTION

In everyday work, constantly present problem of deciding the next step in the procedure. Making a decision in the past was often based on "experience" and "common sense" rather than scientific grounds. It remains the possibility decision to adopt intuitively (simpler cases or complex problems), relying on experience and common sense, but it is unlikely that such a decision would be best. Taking all this into account it appears that in complex interventions, as well as those who hire large financial and material resources, cannot be permitted without prejudice to such freedom in decision making. Then it is necessary first to carry out calculations and based on it to bring the best i.e. optimal decision. The scientific discipline concerned with the scientific foundations of the decision in the organization and provision of manufacturing operations is called operational research. Greatly contributed to the good survey have and implementation of experiments and analysis of large data and information.

Bo about varietal functions in the field of planning and operative is a new set of problems which are called "problem of execution" and appear in conflict to functional units. In solving these problems, it is necessary to use certain measures or a system of actions that predict and are based on clear principles and have a purpose. The operation we call each of the measures or a system of shares, which are united in one idea, are aimed at achieving a particular goal. Operations are actually measures the management, and they are the work of the human mind. The selection of the parameters that characterize the manner of implementation and organization of the operation depends on the expert. Organization term covers a selection of subjective and technical means into action.

The accepted selection of parameters that depends on man called solution. They can be: positive, negative, reasonable, unreasonable and the like. The solution has the advantage over the other is called an optimal solution. Decision that is best for the organization is called the optimal decision. It is the best in terms of function of a part of the organization is called suboptimal decision.

II. GIVEN EXAMPLE OF REAL INDUSTRIAL PROCESS – EXPERIMENTS TAKEN FROM A COMPLEX

The previous carried out laboratory investigations with application of the new collectors CYTEC and frothers confirmed that there is possibility for significantly improvement of the gold recovery with same copper quality and decreasing of the CaO consumption. The investigations with reagents Aerophine 3404, Aero XD 5002 and frother OP-F49 in the previous period (2010) were very short because of the low quality and variations of the ores. Variations of the ore from 0.15-0.22 % Cu, instability of the flotation and other problems in the flotation process. The combination of the Aerophine 3404, KEX:KBX=

1:1, NaIPX, SKIK Bz 2000, in the different points of the flotation process gave significantly better results that early. The process was prolonged with pH=10.5 and the point of addition of CaO was at the hydro cyclone (70%) and 30 % in the flotation process. The conclusions of these investigations were very heavy for sure confirmation, bur the obtained results were close to the previous results by standard conditions (especially for Au), may be better but not significantly. The Au content in the ore was from 0, 19-0, 29 gr/t, in the concentrate 8-12.3 gr/t, with Au recovery from 45-55 % (some appearances up to 60 %), but the copper recovery in the standard interval. Considering these investigations in laboratory and industrial real conditions may be concluded that:

- The instability and relative short period of investigations in the real conditions have contributed for obtaining the technological parameters closed to the standard conditions,
- As a result of the good regrinding, it was very heavy to clean the rough concentrate Cu/Au,
- Using higher pH, higher than standard in the rougher flotation (elimination of pyrite flotation) by Aerophine 3404, it will be expected higher quality and content of Cu/Au,
- In the existing real conditions of flotation at pH 11.0-11.6 and consumption of Aerophine 3404 (AP3404) from 18-22 gr/t, together with change of adaptive changeable reagent regime by different collectors (the combination from Aerophine 3404, KEX:KBX, NaIPX),
- The prolonged changes of the reagent regime with contemporary addition of new reagents (Bz 2000 = 4-8 gr/t + KEX:KBX=1:1 = 8-4 gr/t, total 12 gr/t) in the grinding cycle, together with addition of NaIPX in the condiotioner with 8-10 gr/t, in the flotation process (rougher and controlled flotation) with 2-4 gr/t, or total addition of 14 gr/t NaIPX,
- The results of the technological parameters of the process in real terms has not suffered significant improvements over conventional conditions.

III. MATERIALS AND METHODS

Based on tests performed in laboratory and industrial conditions in the flotation of copper Mine come to the conclusion that future research should be directed towards the optimization with optimization methods that you get to optimize reagent regime. So, based on industry - zero baseline laboratory values of the collectors in the flotation stages analysis is conducted using optimization technique.

Zero starting values of the collectors in the flotation stages:

- X1 - consumption collector NaIPX = 12 gr/t
- X2 - consumption collector KBX: KEX = 1: 1 = 8 gr/t
- X3 - consumption collector SKIK 2025 = 4 gr/t

Variables collectors in various stages of flotation:

- ΔX1 - consumption collector NaIPX ± 3 gr/t
- ΔX2 - consumption collector KBX: KEX = 1: 1 ± 2 gr/t
- ΔX3 - consumption collector SKIK 2025 ± 1 gr/t

TABLE 1. Tests with a plan experiments

Ex.	X_1	X_2	X_3	I_{Cu}%
1	+	+	+	
2	+	-	+	
3	-	+	+	
4	-	-	+	
5	+	+	-	
6	+	-	-	
7	-	+	-	
8	-	-	-	

TABLE 2. Tests with a plan experiments – Bucim Mine

Ex.	X_0	X_1	X_2	X_3	I_1	I_2	$I_{Cu}\%_{sr}$
1	+	15	10	5	90.13	89.05	89.59
2	+	15	6	5	90.52	87.90	89.21
3	+	9	10	5	89.18	88.80	88.99
4	+	9	6	5	86.66	87.22	86.94
5	+	15	10	3	89.10	87.22	88.16
6	+	15	6	3	88.60	90.48	89.54
7	+	9	10	3	88.90	89.62	89.26
8	+	9	6	3	88.00	87.08	87.54

The remaining operating parameters (pH = 11.72, 55-60 % - 0.074 mm during flotating (12 min) and conditioning (6 min)) as standard in industry. Performed two parallel investigations.

The coefficients of the linear model of values for the use of copper in concentrate ICu % are:

b_0= 1/n [89.59+89.21+88.99+86.94+88.16+89.54+89.26+87.54] = 88.65
b_1= 1/n [89.59-89.21+88.99-86.94+88.16-89.54+89.26-87.54] = 0.346
b_2= 1/n [89.59+89.21-88.99-86.94+88.16+89.54-89.26-87.54] = 0.47
b_3= 1/n [89.59+89.21+88.99+86.94-88.16-89.54-89.26-87.54] = 0.03
b_{12}= 1/n [89.59-89.21-88.99+86.94+88.16-89.54-89.26+87.54] = - 0.596
b_{13}= 1/n [89.59-89.21+88.99-86.94-88.16+89.54-89.26+87.54] = 0.26
b_{23}= 1/n [89.59+89.21-88.99-86.94-88.16-89.54+89.26+87.54] = 0.24
b_{123}= 1/n [89.59-89.21-88.99+86.94-88.16+89.54+89.26-87.54] = 0.18

(1)

According to the above tables and results (n = 1/8), a mathematical model of the process of chalcopyrite flotating expressed by using copper concentrate ICu %, depending on the x_1 (consumption collector NaIPX), x_2 (consumption collector KBX: KEX = 1: 1) and x_3 (consumption collector SKIK 2025), in arbitrary units has the following view (first order polynomial):

$$ICu\% = 88.65+0.346x1+0.47x2+0.03x3-0.596x1x2+0.26x1x3+0.24x2x3+0.18x1x2x3$$

(2)

IV. CHECK THE SIGNIFICANCE OF THE MODEL COEFFICIENTS

The error reproducibility of the model coefficients is:

$$S_{bj} = \frac{S_{rlsr.}}{\sqrt{n}} \frac{0{,}514}{\sqrt{8}} = \frac{0{,}514}{2{,}8284} = 0{,}18$$

(3)

Border significant value of the coefficients is:

$$\left|b_j\right|_g = t \cdot S_{bj} = 2{,}306 \cdot 0{,}18 = 0{,}41$$

(4)

where is:
t – criterion Student p = 95 %; t = 2.306
Considering the limit of the coefficients (0.41), the linear model would have shown below formula with coefficients b_0, b_2 and b_{12}. However, if we consider process in real terms (b_1 = 0.346 or 84.4 % of the absolute limit of 0.41), you should take this as an important factor in the equation.

$$Icu\ \% = 88.65 + 0.47x_2 - 0.596x_1x_2$$

(5)

Given the resulting linear model and significance of x1 and x2 parameters for the conduct of the process of flotating as influential factors coefficient before x1 which is below the limit value of 0.41 is taken as an important factor and therefore definitive view of mathematical model of the process serious flotating copper, expressed through the exploitation of minerals of copper, arbitrary units are as follows:

$$ICu\ \% = 88.65 + 0.346x_1 + 0.47x_2 - 0.596x_1x_2$$

(6)

V. FULL FACTORIAL PLAN OF EXPERIMENTS FOR THREE FACTORS IN BUCIM MINE

The plan of experiments is carried out for existing regent regime in the flotation plant in Bucim mine. The obtained result are given in the following table 3:

TABLE 3. Tests with a plan experiments

Ex.	X_o	X_1	X_2	X_3	I_1	I_2	$I_{Cu}\%_{sr}$	I_{pres}	ΔI
1	+	15	10	5	90.13	89.05	89.59	88.87	0.72
2	+	15	6	5	90.52	87.90	89.21	87.93	1.28
3	+	9	10	5	89.18	88.80	88.99	88.18	0.81
4	+	9	6	5	86.66	87.22	86.94	87.24	-0.30
5	+	15	10	3	89.10	87.22	88.16	90.06	-1.90
6	+	15	6	3	88.60	90.48	89.54	89.12	0.42
7	+	9	10	3	88.90	89.62	89.26	89.37	-0.11
8	+	9	6	3	88.00	87.08	87.54	88.43	-0.89

Considering the obtained results will be carried out analysis of the obtained linear model, establishing his adequate. As the model is obtained based on the mean values of recoveries, then the productivity error for the mean values will be:

$$\overline{S}^2_{rlsr.} = \frac{\left[(90{,}13-89{,}05)^2+(90{,}52-87{,}90)^2+(89{,}18-88{,}80)^2+(86{,}66-87{,}22)^2 \right.}{\left.+(89{,}10-87{,}22)^2+(88{,}60-90{,}48)^2+(88{,}90-89{,}62)^2+(88{,}00-87{,}08)^2\right]}{64}$$

$$\overline{S}^2_{rlsr.} = 0{,}264;\ \text{or}\ \overline{S}_{rlsr.} = \sqrt{0{,}264} = 0{,}514$$

(7)

VI. ADEQUATE MODEL CHECKING

After the estimation of the investigated model, it needed to calculate the mean result of each test, and instead x_j in the mentioned model we will put appropriate conditioned units of the test (± 1):

$I_{pres.1}$ = 88.65 +0.346 (+1) + 0.47 (+1) – 0.596 (+1) = 88.87
$I_{pres.2}$ = 88.65 +0.346 (+1) + 0.47 (-1) – 0.596 (+1) = 87.93
$I_{pres.3}$ = 88.65 +0.346 (-1) + 0.47 (+1) – 0.596 (+1) = 88.18
$I_{pres.4}$ = 88.65 +0.346 (-1) + 0.47 (-1) – 0.596 (+1) = 87.24
$I_{pres.5}$ = 88.65 +0.346 (+1) + 0.47 (+1) – 0.596 (-1) = 90.06
$I_{pres.6}$ = 88.65 +0.346 (+1) + 0.47 (-1) – 0.596 (-1) = 89.12
$I_{pres.7}$ = 88.65 +0.346 (-1) + 0.47 (+1) – 0.596 (-1) = 89.37
$I_{pres.8}$ = 88.65 +0.346 (-1) + 0.47 (-1) – 0.596 (-1) = 88.43

(8)

In the above table are given errors $\Delta I = I_{sr.} - I_{pres.}$, and the model adequate may be checked by Fischer criteria:

$$F = \frac{\left[\sum_{i=1}^{N} I_{sr.i}^2 - N \cdot \sum_{i=0}^{k} b_i^2\right]}{(N-k-1)\cdot S_{rlsr.}} \tag{9}$$

Where: k – number of linear members in the mentioned model. In our case, we will have:

$$F = [89.59^2 + 89.21^2 + 88.99^2 + 86.94^2 + 88.16^2 + 89.54^2 + 89.26^2 + 87.54^2] - 8[88.65^2 + (0.346)^2 + 0.47^2 + (0.03)^2 + (-0.596)^2 + 0.26^2 + 0.24^2 + 0.18^2] / 5 * 0.514;$$
$$F = 2.157 \tag{10}$$

For $f_b = 8-2-1 = 5$ and $f_r = 8(2-1) = 8$, for confidential level p = 95 % =3.69, and Student = 2.306, Fischer criteria:

$$F^* = f_r + p + t = 8 + 3.69 + 2.306 = 13.996. \tag{11}$$

As F << F^*, the model is adequate. It means that investigated process is correct described by means of polynomial of the first order and the difference which is appeared between experimented and estimated results is accidental.

VII. THE DETERMINATION OF THE OBTAINED LINEAR MODEL GRADIENT FOR REAGENT REGIME IN THE FLOTATION PLANT IN BUCIM MINE

The gradient method is based on the fact that biggest degree of improvement for a function is achieved if the progressive by the length of the gradient. As this direction is direction of the steeper gradient, then we are talking about for maximum, or the direction of the steeper fall. In fact, the gradient is vector for a point of the n-dimensional space. This one is determined by the determination of the first derivations of the aim function in the relationship of their changeable factors. It is important to note that the gradient direction is a local, not a global property. If we suppose that the function $y(x_1, x_2,)$ which has had continuous partial derivations, then there is the point (x_1, x_2), around which for a little small change in the every one direction will be obtained the following estimation.

$$\frac{df}{dx_1}(x_1, x_2) = \frac{df(88.65 + 0.346\,x_1 + 0.47x_2 - 0.596x_1x_2)}{dx_1} = -4.422$$

$$\frac{df}{dx_2}(x_1, x_2) = \frac{df(88.65 + 0.346\,x_1 + 0.47x_2 - 0.596x_1x_2)}{dx_2} = -6.68$$

$$m_1 = \frac{\frac{df}{dx_1}(x_{1,})}{\sqrt{(\frac{df(x)}{dx_1})^2 + (\frac{df(x)}{dx_2})^2}} = \frac{-4.422}{8.012} = -0.55$$

$$m_2 = \frac{\frac{df}{dx_1}(x_{2,})}{\sqrt{(\frac{df(x)}{dx_1})^2 + (\frac{df(x)}{dx_2})^2}} = \frac{-6.682}{8.012} = -0.83 \tag{12}$$

The direction will be shown as a vector φ marked with n numbers (m_1, m_2 . . . m_n).

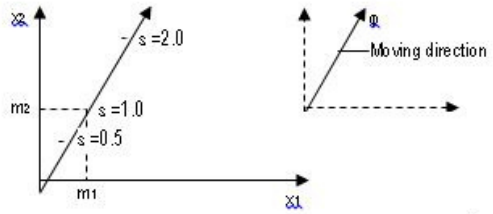

Figure 1. Direction of search

$$\frac{m_1}{m_2} = \frac{-0.55}{-0.83} = 0.663$$
$$m_1 \cdot \Delta x_1 = -0.55 \cdot 3 = -1.65$$
$$m_2 \cdot \Delta x_2 = -0.83 \cdot 2 = -1.66 \tag{13}$$

Obviously, we are in the direction of the gradient and the variable x_1 and x_2 should be set moderately to one another, because b12 interaction coefficient with its sign shows it.

Standard deviation $\sigma = \sqrt{\frac{\sum \Delta I^2}{7}} = 1.03$

By the analysis of the linear model of polynomial of the first order for copper recovery from the chalcopyrite ore, above mentioned equations for carried out investigations by decreasing of the collector (x_1– NaIPX) and with increasing of the (x_2– KEX:KBX=1:1), we'll be obtained following results in table 4.

TABLE 4. Tests with a plan experiments

I_1	I_2	$I_{Cu\%sr}$	I_{pres}	ΔI	ΔI^2	$\Delta I^2/7$
90.13	89.05	89.59	88.87	0.72	0.52	
90.52	87.90	89.21	87.93	1.28	1.64	
89.18	88.80	88.99	88.18	0.81	0.65	
86.66	87.22	86.94	87.24	-0.30	0.09	**1.07**
89.10	87.22	88.16	90.06	-1.90	3.61	
88.60	90.48	89.54	89.12	0.42	0.17	
88.90	89.62	89.26	89.37	-0.11	0.01	
88.00	87.08	87.54	88.43	-0.89	0.79	

TABLE 5. Tests with a plan experiments

Exam	X_1	X_2	I_1	I_2	$I_{Cu}\%_{sr}$
1	11.5	10.5	90.0	89.2	89.6
2	11.5	9.5	90.4	90.0	90.2
3	9.5	10.5	90.1	89.3	89.7
4	9.5	9.5	89.7	89.3	89.5
5	11.5	10.5	89.2	89.2	89.2
6	11.5	9.5	89.2	90.0	89.6
7	10	10.5	90.4	90.2	90.2
8	9.5	9.5	88.7	88.3	88.5

The other working parameters (pH=11.72, 55÷60 % - 0.074 mm, flotation time 12 min and time of conditioning 6 min and X3 = 4÷6 gr/t) are standard as in the real industrial conditions. The copper recovery in the ICu %sr is optimal or need minimum decreasing of collector consumption of NaIPX = 10-11.5, and increasing of KBX: KEX=1:1 = 9.5÷10.5 gr/t, according to the influence of the feed ore quality, bigger content of copper in the feed, bigger consumption of the collectors.

VIII. CONCLUSION

In this paper is shown optimization techniques with formatting the mathematical model and adequate model for carried out investigations. Obtained tabular results and figures will show the optimal quantity in reagent regime (collectors), particle size, flotation time for rougher flotation, conditioning time etc.

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Blogs in Autonomouns Learning Encouraging Reflective Practices

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Abstract – The current paper provides literature overview on how asynchronous computer-mediated communication (Blogs) impact autonomous learning as the result of reflective practice. The paper presents review of literature on: Learner Autonomy, Language Learning, Social Constructivism, Intercultural Competence. Conclusion of this paper advantages of blogs as metacognitive and cognitive abilities including the possibility of accessing the internet, which are of great importance for the use of blogs to enhance students autonomous learning and intercultural communication.

I. INTRODUCTION

Teacher-driven classrooms have become pedagogically limited in student-centered instruction that inhibits learners' abilities to learn autonomously. As defined by Little (2003), autonomy deals with decision-making, critical reflection and social interaction. Autonomous learners take responsiblity in their own learning and activley engage in learning processes by means of setting personal goals, planning and executing tasks, and reviewing their progress (Dam, 1995; Little, 1996). Teachers support and facilitate autonomous learning by providing guidance and motivating students to make their own decisions and solve problems. As seen from a socially constructive perspective, autonomy results from combining social and reflective processes (Little, 2003). Benson (2003) concluded that during social collaboration, students work as a team with colleagues through which they cultivate high order cognitive skills by observing, analyzing and evaluating information.

One of the best means to enhance students' autonomy is computer language learning (Benson, 2004; Lee, 2005; Murphy, 2006; O'Rourke & Schwienhorst, 2003). The emergence of Web 2.0 technologies (wikis, blogs, podcastings) completely changed and has improved online learning. The use of blogs on the other hand is closely related to their pedagogical function. Personal blogs are a collection of online journals that contribute to the creation of thoughts and self-reflection (e.g., Lee, 2010; Yang, 2009), while the quality of collective blogs is to encourage joint and interactive learning (Lee, 2009b). Blogging helps that students have their autonomy, to be independent and to themselves make their own decisions about what, how long and at what time will post their work (Lee, 2010). As pointed out by (Baggetun & Wasson, 2006; Ward, 2004), blogging is also contributing to the regulation and planning of students learning.

Being asynchronous CMC, blogs help students build understanding at their own pace, enabling them to better analyse the content (Armstrong & Retterer, 2008; Campbell, 2003; Murray & Hourigan, 2006; Richardson, 2005). Additionally, Lee (2010) notes that blogs boost students' participation and motivation because they not only target a sole instructor but rather are meant for a broader audience. While blogging introduces pedagogical potentials related to autonomous learning, the access to networking stays in participation levels (Belz, 2002; Lee, 2004). Having no Internet access at home or school creates stress and frustration for students. As a result, the quantity of engagement decreases along with the quality of work done (Peterson, 1997).

With the previously mentioned advantages, blogs have been increasingly added in L2 instruction across subjects. Research studies have shed light on our knowledge of the use of blogs for cultivating reading and writing skills (e.g., Bloch, 2007; Churchill, 2009; Ducate & Lomicka, 2008;

Lee, 2010; Murray & Hourigan, 2006). To increase intercultural education, blogs have been mixed into normal classes as well as study abroad programs (e.g., Elola & Oskoz, 2008; Lee, 2009b; Sun, 2009). Current CALL research, however, does not give much attention to problems dealing with autonomy, as suggested by L2 researchers (Benson, 2006; Blin, 2004; Chapelle, 2001; White, 2003). To explore new ideas dealing with the emergence of autonomy outside of the classroom, the current study tested how blogs in addition with ethnographic interviews foster student autonomy.

With a socially constructivist approach, the study was composed of 16 American undergraduate students who took part in a blog project to increase their intercultural attitude over the course of one-semester of a study abroad program. As a course prerequisite, the blog project goal was to use (a) individual blogs to give students personal spaces to write and reflect upon their memories with the host culture and people on a regular basis, and (b) a class blog to open a social community where students and L1s shared cross-cultural ideas using teacher-assigned topics.

Real-time ethnographic meetings with local L1s as part of the class blog gave students aboard more chances for FTF intercultural exchanges. Combining the two sources of communication (CMC and FTF) further enhanced students' learning potential according to their learning styles and personal interests. Importantly, blogs and ethnographic interviews helped students to enhance their cultural interpretations both independently and collaboratively outside of class. The research study looked into the correlation between reflective blogs and self-directed learning from students' points of view. Additionally, factors that had an impact on autonomous learning within the online learning environment were further looked into.

II. Learner Autonomy in Langugage Learning

Recently, awareness of autonomy in learning has greatly expanded in the area of language education (e.g., Benson, 2003; Hurd & Murphy, 2005; Lamb & Reinders, 2008; Little 2001; White, 2003). Although autonomy has been defined in numerous ways, it came about from the idea that an individual should take ownership of their own learning and is often realized by the ability to take initiative, monitor progress and predict the result of learning (Benson, 2001; Benson & Voller, 1997; Holec, 1981; Little, 2003). As noted by Little (1994), learner autonomy is "the product of interdependence rather than independence" (p. 435), which outlines the relationship between group and personal actions. Correspondingly, Benson (2001) concludes that autonomy is backed by the social constructivism of effective learning. Autonomy doesn't signify that learners work in solitude.

Comparatively, they socially build knowledge by dynamically participating in the process of learning. Through social cooperation, learners foster skills to analyse, reflect upon and synthesize information to develop new views. Taking this into account, Little (1996) signifies that critical reflection builds on "the internalization of a capacity to participate fully and critically in social interactions" (p. 211). Internalization activities makes an individual transition to become an independent learner by taking an eager role in learning progress rather than simply acting on external stimuli (Dörnyei, 2005).

The value of self-management (Rubin, 2001), self-motivation (Dickinson, 1995; Lamb, 2004; Ushioda 2006), self-confidence (Wenden, 2002) and learning strategies (Oxford, 2003) for learning autonomy have also been noted by researchers. The difficult part, however, occurs in learners interests in the cognitive, metacognitive, social, and affective parts of language learning (Little, 2001; Reinders, 2006). Hard work, accordingly, needs to be initiated on training students to learn autonomously with teacher interference and support (Benson, 2001; Dam, 1995; Little, 2007). As shown in the previously stated concepts and skills, the idea of autonomy is composed of a relatively big total of constructs broadly acknowledged by L2 teachers as pedagogical assumptions. For the direction of the current study, self-directness, critical reflection and cognitive commitment through social communications are the main factors of autonomous learning for the blog project. The next piece of text takes a look at autonomy in CALL for out-of-class learning backed by a social productive method.

III. Social Constructivism for L2 Learning and Autonomy in the CALL

As pointed out by (Warschauer, 2003) in time there has been a crossing when it comes to research by CALL, with the students' interaction with computers to human interaction through a computer. In support of the call it has been is

employed constructive paradigm of language learning as theoretical framework by which is achieved mutual construction of knowledge call (e.g., Hauck & Youngs, 2008; Lee, 2007, 2008). Duffy and Cunningham (1996) state that, "Learning is a social and dialogue process of creation of multidimensional selves by using tools and characters created by the communities with whom they are in contact" (p. 181-182). Unlike from the learning, residing is one-way transactions of teachers' knowledge, an active, social and collaborative process in which students through appropriate symbols (language) and material resources (computers) achieve the knowledge building with others, in order to achieve a common task (Lee, 2004; Pavlenko & Lantolf, 2000). Scaffolding which are normally used for the construction of L2 knowledge, allow students to expand their zone of development (Vygotsky, 1978), ie. the distance between what they can achieve by their own actions or with the help of others. The product of this independence is that the student acquires and can operate in a self-regulated circumstances (e.g. Donato, 2000; Lee, 2008).

Researchers agree that CALL offers catalytic conditions in the construction of knowledge, joint interaction with peers and critical insight to content (Benson, 2001, Blin, 2004; Leahy, 2008; Meskill & Rangl, 2000; Murphy, 2006; Schwienhorst, 2008). How Dang (2010) points out, these elements are a prerequisite for the creation of an autonomous learning. In other CALL applications can be included electronic tandem of language learning (E-tandem) which allows that L1s two different languages work together with the aim of discovering common cultural and linguistic characteristics. Germany and Spain are the countries that have been created E-tandem projects over the years. E-tandem provides mutual benefits of exchange to both parties, relying on the principles of reciprocity and autonomy, and it makes that each party is responsible for their own learning, bearing in mind what, how and when to carry out the tasks of learning (see Brammerts 2001 for a review).

In the context of CMC online learning is viewed as a supplement to learning in the classrooms, where students are given the opportunity, to a greater extent, control their learning and thereby increase social interaction and cognitive engagement (eg, Hewitt, 2000; Jeong, 2004; Lee, 2005; Sykes, Oskoz, & Thorne, 2008). When compared to a real time CMC, asynchronous communication allows students to spend more time studying their own ideas which indicate critical thinking (e.g., Abrams, 2005; Arnold & Dozens, 2006; Jonassen, 2003; Lamy & Goodfellow, 1999). How Lee (2009a) points out, the committee has provided greater understanding of the learned principles and practices between students and teachers. For promotion of student autonomy critical attitude towards the content is essential, Lamy and Hassan (2003) emphasize that it should primarily be explained to students. Factors that influence students to join the online teachings are primarily affective as example relations to learning tasks.

IV. Establishing Intercultural Aptitude: Blogs and Ethnographicd Interviews

The requirements for language students to build intercultural communicative competence (ICC) was actively proposed as a critical piece in L2 instruction. Byrams (1997) ICC model outlines a theoretical scheme composed of four-correlated parts—knowledge, skills, attitudes and awareness—happens to be the most popular approach in developing intercultural aptitude (see pp. 50-63 for details). As a part of this scheme, the intention is to bolster cultural schooling that goes beyond a one-dimensional “facts only” path. To excel at being intercultural speakers, students need to be impartial to society of other cultures so that they grasp cross-cultural viewpoints with accepting demeanour and appreciation (Bennett, 1993). When developing ICC, students are pushed to echo upon the cultural comparisons and discrepancies, and further gain the skills to accept dissimilarities that allow them to deal with situations encountered with L1s. Traditional knowledge advises that formal classroom guidance on its own is not enough and intimate communication with L1s is crucial for learners to develop ICC.

As with other ways of intercultural education, blog technology is being used more to enhance multicultural communication and appreciation (e.g., Carney, 2007; Ducate & Lomicka, 2008; Elola & Oskoz, 2008; Lee, 2009b). Experiments have shown that blogs give learners the chance to develop cultural awareness from a variety of different angles of view (Elola & Oskoz, 2008; Pinkman, 2005). For instance, using task-based exercises, Lee (2009b) in her previous study of Spanish-American remote collaboration showed how group blogs helped students by

fostering cultural appreciation through ethnographic discussions. In contempt of desired results, Carney disputes that blogs create a new online conversation forum and not a deeper cultural transfer due to the post-comment architecture of blogs that develops into brief exchanges and missing consistency. Thus, educators need to create methods, such as using guided inquiries, to spark an interest in learners' high order thinking in order to construct upon future conversations.

V. CONCLUSION

One more popular method of developing ICC is through the utilization of ethnographic discussions, having been put in place in both CMC and FTF environments. Ethnographic interviews enhance real-world communications where an inner view is uncovered to help better interpret cross-cultural diversity. Critically, ethnography counts chiefly on a consideration of the elemental values, beliefs and attitudes of others through in person investigations (Allen, 2000). Experimental findings in FTF environments depict that ethnography nurtures learners' openness and interest toward the target culture and increases cross-cultural consciousness (e.g., Bateman, 2002). Jackson (2008), for instance, described on a case study of Chinese learners who took part in ethnographic discussions. Outcomes revealed that most students furthered their intercultural sympathy and awareness after a 5-week overseas workshop.

Inside the CMC context, Lee (2009b) and O'Dowd and Ritter (2006) announced that students enhanced cross-cultural attitudes through discussions with L1s. Recently, a CMC review held by Jin and Erben (2007) showed that students of Chinese advanced more intercultural sensitivity and displayed appreciation for cultural diversity when using an instant messenger (IM), a text-based messaging tool. IM enabled learners of Chinese and L1s to communicate and transfer ideas in real-time. The procedure of investigating and reflecting on L1 informants' points of view gives students the change as foreigners to learn about the cultural system governing the what, how, and why of insiders' explanations in daily conversations (O'Dowd, 2006).

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Comparative Analysis of the Open Source Tools Intended for Data Encryption

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Abstract - Prevalence of cryptology as a science and treatment in order to protect the data led to the development of a large number of commercial and open source tools intended for data encryption. All tools have been developed to protect data from theft and misuse. The paper are considered and presented differences free open source tools intended primarily to give users the security of data. The tools described in this paper (VeraCrypt, DiskCryptor, AxCrypt and AEScrypt) represent one of the most used open source tools that are used to protect data and provide users with an easy way to protect data without having to know cryptography as a science.

I. INTRODUCTION

As one of the important aspects is to ensure the protection of digital data stored on computer disks. In addition to commercial programs are also available open source programs that can allow us to easily and efficiently protect their data. This paper describes the open source tools (VeraCrypt, DiskCryptor, and AxCrypt AEScrypt) designed to protect the data in an easy and simple way for end users.

The aim of the research is to find adequate tools that end users provides confidentiality and data integrity and satisfactory performance in terms of speed of operation of software tools. Comparison of tool is divided, considering that VeraCrypt and DiskCryptor intended primarily protect the hard drive, while the tools and AxCrypt AEScrypt designed to protect files.

II. OPEN SOURCE TOOLS INTENDED FOR DATA ENCRYPTION

Open source tools that were observed during the survey represent the most frequently used and the recipients of the data protection on the hard drive or partition is (VeraCrypt and DiskCryptor) and protect individual files (AxCrypt and AEScrypt).

A. VeraCrypt

VeraCrypt is one of the most popular open source tools for data encryption, is proposed as the perfect replacement for TrueCrypt. The application supports work on Windows, Linux and Mac OS X operating systems. The program provides users with a variety of encryption algorithms AES, Serpent, and Twofish as well as any combination thereof, and the key length is 256 bits. In addition to encryption algorithms, and users have available hash algorithms RIPEMED-160, SHA-512 and Whirlpool algorithm. The selected hash algorithm used together with random data generated by the program in RAM computer memory as a parameter to the function by Random Number Generator. This function generates major and minor keys.

Random data that is generated by the program and are based on the movement of the mouse (Figure 1), using the keyboard or the number of parameters related to the hardware and operating system of your computer. The installation is simple and after starting program is necessary to make a separate file (Container) that will represent the data warehouse that we want to protect. Creating a Container is done through the interface of the program and further work is called a "volume" file. When creating a "volume" size is necessary to choose cryptosystem, hash algorithm and password that will be used subsequently to be accessed formatted container. The maximum length of the password that the user can enter the 64 character.

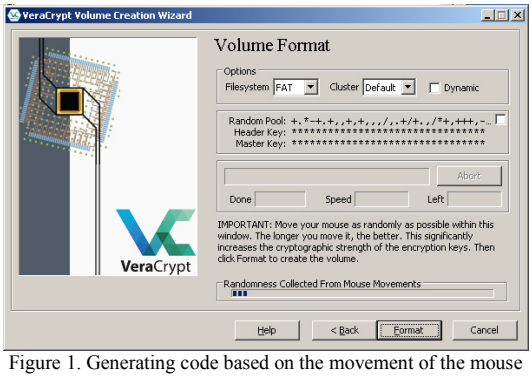

Figure 1. Generating code based on the movement of the mouse

After creating the "volume" file is necessary to upload the same file as an open folder on your

computer that you access or mount function to select a previously created file and enter the password defined. At this point the Computer folder appears in the new disk that represents an open version of selected volume files, which can be archived data to be protected. After storing or archiving data that should be protected, open volume file should be closed.

The advantages of this tool is data encryption feature on-the-fly-encryption. On-the-fly-encryption feature provides the ability to encrypt data automatically right before their storage and decrypted after their transfer or placement of the volume file. This means that data can be easily transferred to any other folder on your computer or moving them lose their protection as they are protected only when data are stored in folume file.

B. *DiskCryptor*

This open source program provides encryption to files and entire partitions. It was developed as a replacement for DriveCrypt Plus Pack and is licensed by the GNU GPL (GNU General Public License). This tool provides users with a variety of encryption algorithms AES-256, Serpent, and Twofish. Users can encrypt data to one or a combination of multiple algorithms. It is supported on Windows operating systems to 32-bit, and 64-btinim. The tool is written in assembler and C programming language.

After a simple installation and startup of the program is necessary to select the partition or hard disk that we want to encrypt. After selecting encryption algorithm is necessary to enter the correct password. It is noteworthy that for different cryptologic algorithms speed program which encrypts the data is not the same.

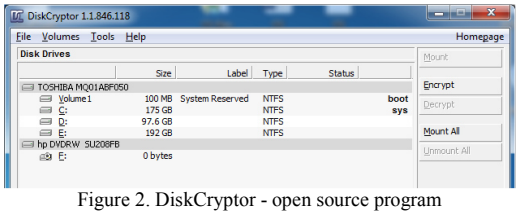

Figure 2. DiskCryptor - open source program

After installing and launching the program you need to select the partition that needs to be encrypted. After selecting the partition must be selected for encryption algorithm and then enter a password and encrypt the partition begins. Depending on the size of the partition encryption can take several hours. Partition encryption process can be interrupted and continued at a convenient time.

C. *AxCrypt*

AxCrypt is open source program to encrypt files on a Windows system, available in both 32-bit and 64-bit operating systems. The program is available in 12 languages and is licensed by the GNU GPL (GNU - General Public License). Besides this available source code, written in C++ and C# programming language, and its algorithms. The program uses AES encryption with 128-bit keys and allows extremely simple file encryption via the menu in Windows Explorer, and just as easily decrypt double-clicking on the encrypted file. After processing and closing program will automatically re-encrypted files to protect. Also it allows you to create executable files with encrypted document that can be decoded on a computer that is not installed AxCrypt.

It is worth noting that in the case of encryption folder for the output process does not receive an encrypted file, but all files within that folder are encrypted individually. After right-clicking and selecting AxCrypt items, the user has several options available: encryption, encryption, a copy of file and encrypting a copy of in ".exe" format, while the first two options result in a file with ".axx" extension. If you want to encrypt a file will select Encrypt option and the subsequent open window we will have the ability to encrypt files with a password or a file-key or a combination of these two options that represents an even greater security.

If we choose to encrypt the file data can use any file but also this tool allows the generation of a new file that used in the encryption of data. To generate file encryption is used PRNG (The pseudo random number generator) with SHA1 as the hash algorithm. By creating a collection of randomly generated value comes on the basis of moving the mouse, using the keyboard, which is an initialization vector. If the user chooses a password to encrypt data and files both keys pass through the SHA1 hash algorithm and subsequently used as the key to encrypt and decrypt data.

D. *AESCrypt*

This program for data encryption uses a symmetric algorithm AES block and is available on Windows, Linux and Mac OS operating systems. In addition to the operating system used on computers, this program has been developed for use on mobile and tablet devices, and is supported on Android (called Crypt4ALL Lite)

and iOS platforms. With this tool it is possible to encrypt one or more files (selecting) the easy way.

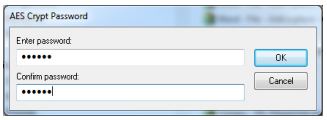

Figure 3. Entering a password for file encryption

When data encryption is used AES-256 algorithm, placing a service means that data is encrypted in blocks of 128 bits in 14 rounds, using a key of 256 bits. After file encryption (at the same location) appears in an encrypted file with the extensions ".aes". Decryption is done in a similar way after right-clicking on the encrypted file is needed from the drop-down menu, choose AES Decrypt option and entering the correct password on the same site appears in a file that is open.

III. COMPARATIVE ANALYSIS

When comparing tools for encrypting data were analyzed features of the programs, security, and ways in which to protect data (algorithms used) and the way they work.

A. Security

Security programs that provide this reflected in the safety data encrypted, and the cryptographic algorithms used in data encryption. AxCrypt AESCrypt and data encryption using AES algorithm, while VeraCrypt and DiskCryptor and security issues are certainly programs that provide secure data protected, as they use AES-256, Serpent, and Twofish encryption of data. In addition it is possible to use a combination of the above algorithms.

Of these software tools for data encryption AxCrypt stands out that provides the ability to file encryption and crypto-file which can be arbitrary, or generated by the program.

B. The layered of encryption

The layered of encryption is reflected in what analyzed programming tool can be encrypted. It is divided on the hard disk, partition, file.

TABLE 1. The layers that cryptographic tools can be encrypted

Tool to encrypt / encryption layer	HDD	Partition	File	Swap space	Hibernation file
VeraCrypt	YES	YES	YES	YES	YES [1]
DiskCryptor	YES	YES	NO	YES	YES
AxCrypt	NO	NO	YES	NO	NO
AESCrypt	NO	NO	YES	NO	NO

C. Operating mode

Open source tools (VeraCrypt, DiskCryptor, AxCrypt, AESCrypt) were compared to the mode or by encryption capabilities:

- with predisctable vector of initialization,
- with secret vector of initialization,
- with random keys,
- specially designed to encrypt data - LRW (Liskov-Rivest-Wagner) and
- based on standard IEEE P1619 (XTS).

TABLE 2. Modes of operation tools for data encryption

Tool to encrypt / encryption layer	with predisctable vector of initialization	with secret vector of initialization	with random keys	LRW	XTS
VeraCrypt	NO	NO	NO	NO	YES
DiskCryptor	NO	NO	NO	NO	YES
AxCrypt	NO	NO	YES	NO	NO
AESCrypt	NO	NO	YES	NO	NO

D. Speed encryption

Testing speed operation, and measurement speed encryption is done on a computer that has hardware is provided by an Intel Core i3 3217 processor, 4 GB RAM 1600MB/s DDR3 and integrated graphics.

Speed of data encryption is an essential tool in choosing which plan to use for data protection. Considered partition the hard disk has a capacity of 206.504.456.192 bytes, or 192 GB. Content that is placed on the partition and which is necessary to protect the size is 720,30 MB.

Running time to protect observed files tool VeraCrypt is 1 hour and 53 minutes, or 113 minutes, while the time to encrypt observed the same partition (DiskCryptor tool) with the same data stored on it, was 2h and 51min, or 171 minutes.

[1] Only on Windows operating systems

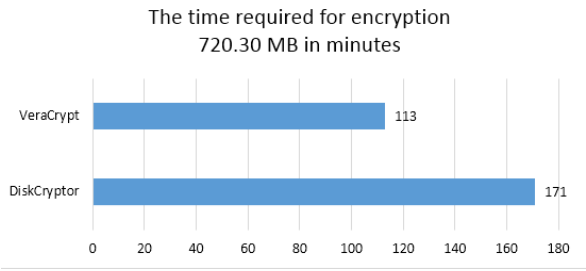

Figure 5. Speed encryption facilities size 720,30 MB

Subsequently, on the same disk partition located more information, or 165,50 GB (55899 files in 8380 folders). Weather for the encryption of the amount of data is much larger and is shown in the following figure.

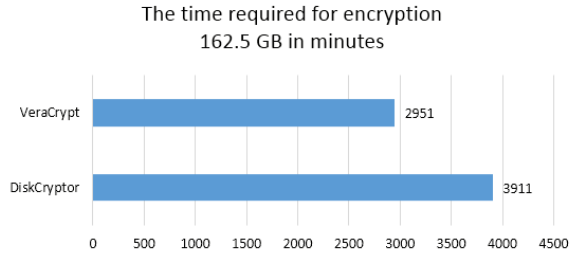

Figure 6. Speed encryption facilities size 162,50 MB

The time that was necessary to protect observed files tool VeraCrypt is 49h and 11 min, or 2951 minutes, while DiskCryptor program had to be 3911 minutes, or 65h and 11 minutes.

Both tools for data encryption AES protocol used (for knowledge hash SHA-512), which is the fastest of the available algorithms to encrypt the data.

It is notable that the size of the observed data, which is necessary to protect the weather will significantly increase, as these tools are not in favor and tedious for end users.

Analyzing these two tools considered slight advantage on the side of the program VeraCrypt, due to ease of use and installation, but also because of the speed of data encryption, which is extremely important to end users.

After analyzing the work and comparisons of these tools are accessed compared to the other two tools AxCrypt and AEScrypt. When comparing these two tools are protected by two identical (text) file. The contents of files are encrypted the form of text, and the sentence "This is the text that must be protected". The goal of comparing these two tools is a description of the differences observed by the character images are displayed in Notepad ++.

Encrypting the observed file (the size of 32 bytes) tool AxCrypt obtained a new file, while the existing (observed) disappears from the directory. Newly created file (extension .axx) size is 366 bytes. After opening a new file in Notepad++ displays 366 characters in five rows.

The analysis of the newly created file to the analysis [7] we obtain the following information:

MD5 Hash:
d9d6b12d72c05af24a7672fb63201e1c

SHA1 Hash:
d77b1a0f1fd2b291c42edb6952d65e452e9d1355

SHA256 Hash:
6dc89fa13c6f4ef0f80a6e0bd49f72f0282ca9004dd
0a58f182613f196b9f65f

The same file (the size of 32 bytes) is encrypted AEScrypt tool. Now in the directory next to the monitored file appears additional, newly created files with the extension .aes. File size is 338 bytes, and after opening file in Notepad++ receives the character string, a total of 338, arranged in five rows. According to [7] come to the following data:

MD5 Hash:
8413dce0449ea7a58686216d693ec8f4

SHA1 Hash:
51587ada414e6429acf02cd27939c1af96d11915

SHA256 Hash:
6954fc4ccf12b21bcafc89d65a31d0dbb17dc79c1242
b3da0b5c889170fe1488

Since AEScrypt tool has no possibility to protect files crypto-file is not possible to make a comparison with the tool AxCrypt. When the monitored file encryption crypto-file and password created the new file size of 382 bytes, after its opening in Notepad++ displays a series of incomprehensible characters, a total of 382 placed in four rows. According to [7] come to the following data:

MD5 Hash:
2e983315f62421244e7a678f4bf2d29f

SHA1 Hash:
0c2a2227347f2ff6b2badac91b1318dc2e1bcdae

SHA256 Hash:
0ca34c17574759aaa06951707df75d3c14c85e0b1edd
f8fe6085955e8a851c78

When compared only with encryption tool AxCrypt can see that in the second case, or using crypto file observed secure file provided. Or to the same file using a key file we get a file that is in our case in terms of file size increased to 16 bytes (Figure 7). Key file that was used also file created in Notepad (.txt extension) and in it is contained the text "key", which is also used as a password when encrypting these files.

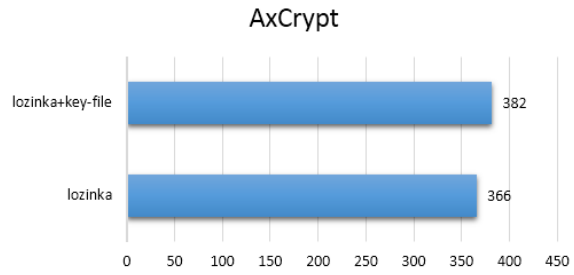

Figure 7. Using AxCrypt encryption tools for file encryption

When we look at AxCrypt encrypted files and AEScrypt notes that a file is encrypted with AxCrypt tools increased by 28 bytes or 366 while a file is created using tools AEScrypt size of 338 bytes (Figure 8).

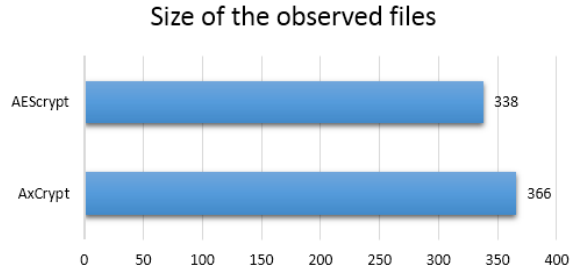

Figure 8. Size observed analyzed file using tools

Analyzing these two tools considered AxCrypt provides greater security since it first of all deleted files, which are encrypted and leaves only the directory file, which is protected, in addition, create a file larger size, or file that has more bytes. Protection of files this tool is also provided using the crypto-file as well as the combination of crypto-file with a password. The tool can create a crypto-file, that file is generated based on the current file length of 54 bytes.

IV. CONCLUSION

The need for protection imposes itself primarily because of the frequent stealing of data and abuse, spreading them over the Internet and social networks. Tools such as VeraCrypt, DiscCryptor, and AxCrypt AEScrypt can provide adequate data security adequately.

The result of research allows users access to the existing (and usually use) open source tools for data encryption, analysis and differences in the work of the same. In addition to the display of open source tools including the results of research in terms of speed of operation of the tools themselves, or speed encryption of data whose integrity needs to be preserved.

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Negative Aspects of Using IT Technologies in Serbian Education System

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Abstract – Slowly but steadily, the educational system of the Republic of Serbia is getting updated. The main carriers of this trend are the young generation of teachers. Although these attempts to improve the situation are sporadic and individual, some of them proved successful and popular with students. In this way, the education process not only becomes more interesting but also prepares the students for the practical work after their schooling. Numerous authors are in favor of this trend and present IT as the new educational means. Nevertheless, the practice has identified certain negative aspects of the educational process through use of IT, which occurred after implementation of new technologies as an educational means - instead of improving the educational process, IT deteriorate it at times. Therefore, these negative aspects need to be identified and solved first, for the new way of educating students to be truly successful. This paper will present these negative aspects, their results and the models of their tackling.

I. INTRODUCTION

It is a well-known fact that the current state of educational system is not compatible with the students' needs and expectations. Whereas on one hand, teachers insist on giving traditional, frontal lessons, the students, called 'digital natives' by [1], on the other, willingly spend most of their leisure (and recently even productive) time surrounded with the IT, especially mobile technologies. Thus, the teachers are dissatisfied with the students' discipline, performance and results of the educational process, and the students are simply - bored. It is clear that the situation has come to a point where change is necessary.

However, certain strives to improve this situation do exist, coming from young generation of teachers as their carriers. While on one hand, this is more than positive, on the other, not doing this in a strategic and systematic way leaves a large opening for mistakes and negative results to be delivered. Alongside the disparity presented in this section, this situation calls for certain change in ways the education is presented to the new generations. This should be done in a carefully planned and staged process.

The structure of the paper is as follows: Section II shall present the negative aspects occurring in IT-supported educational system in Serbia and their results. Section III shall provide the models of solving this situation, after which certain conclusions and recommendations for the future shall be given in Section IV.

II. NEGATIVE ASPECTS OF USING IT TECHNOLOGIES AND THEIR RESULTS

Even though new technologies significantly influence our everyday life, the initiative to introduce them as an official educational means is far from ideal. Without systematic introduction, the problems arising from this strive can be multiplied. They are presented in the following subsections.

A. Relevance and Reliability of the Online Data

According to [2], every day sees new 2.5 billion gigabytes of data generated globally, out of which 4/5 is unstructured. While on one hand this means far greater accessibility to information in comparison with the past times, on the other, the 'filter' previously existing in the form of scientists/writers who were highly educated in the field in which they were writing, thus providing valuable and reliable information to the wider society, is nearly non-existent in the case of most Internet sources. Since the emergence of Web 2.0, every person having access to the Internet can post information with little or no control over the process. Currently emerging Web 3.0, recognizing the IoT as the information provider, makes this situation even more complex.

Young generations, as shown in [3], proved to be trustful towards majority of Internet sources, usually choosing the first several engine search results as completely reliable. The situation as is calls for ways to teach them to wisely browse and choose information to implement in their body of knowledge, which shall be discussed in the following section.

B. Literacy

Computer literacy and use of new technologies are two skills highly required in the business world. The current situation sees a significant shift towards this

trend, at expense of handwriting and reading hard copies of books. Spellchecking tools built in text processing programs are useful on one, but on the other hand, users of these programs tend to avoid memorizing the spelling of the words, knowing that they can always get help from the program. The result is that, while feeling familiar in the field of information technologies, young generations seem to lose the will and even ability to write by hand and read for pleasure. In further, developmental instance, this means narrowing of vocabulary and thesaurus, shorter and less structured sentences and loss in ability to express thoughts and emotions with the young generation.

As a solution, the two ways of expression could be blended in a way, so that the students retain the trend of reading and writing, but also the pen-to-paper technique. This is to be addressed in the following section.

C. Digital 'Cheating'

This problem is present not only in the classroom and while doing homework, but also in the adulthood, at workplace. The root of it lies in the human nature and inherent laziness, implying 'running away' from work. In this context, this means absenteeism through using the computer for other purposes at the time when it should be used for the educational ones. The students use their intelligence and IT skills to somehow avoid fulfilling their duties and learning - instead of reading the required books, students find certain interpretations (of questionable reliability) on the Internet and use them to 'prepare' for the lessons. Thus, instead of working for their knowledge and getting the mark, students put minimal effort into studying and get instant results.

Moreover, the knowledge pool seems to be migrating from people's memory to the servers and cloud services, since students use their mobile phones to search for answers to questions in tests, instead of answering them based on their knowledge gained through the process of studying and revision.

Finding required information fast and in stealth, certainly requires some skills from the students. Students might become highly skilled in searching for information, but on the other hand may not be able to memorize it as required. This is the place where an important question should be made – should memorizing (mostly unnecessary) data be imposed to the young generation, or the system could adapt to the new trend of using technology to search for data stored in sources which are more relevant than our mere memory?

D. Era of Distractions

Another problem in focus is the large number of distractors faced by all IT users daily. Most materials found online today are shortly-tailored, with texts of two or three short paragraphs and videos no longer than two minutes. This constant supply of available entertainment contents has significantly deteriorated the attention span both to students and working people. Consequently, students experience struggle following in-depth discussion and staying focused throughout a regular classroom period, making it difficult for teachers to work through their lesson plans.

Additionally, services like Viber, WhatsApp, Snapchat, or social networks like Facebook, Instagram, Twitter and such, make a wide channel for information flow and real-time communication at a low or no cost. Additionally, these services and networks provide a lot of interesting information, therefore being inevitably desirable to use. All these, combined, result in frequent workflow interruptions and losing focus from working on certain topic, to keep up with the parallel, online life.

Certain institutions solve this problem by limiting or even disabling access to certain web pages within their internal network, which does not stop the students to browse Internet from their mobile phones, completely out of the institutions' control.

Again, a question should be asked in this place. Instead of (mainly unsuccessful) strives to prohibit the use of mobile phones in lessons, schools should inspect the reasons why the students are absent-minded in class and in which way the atmosphere can be achieved, in which they will not even think about not listening in the class and spending their time looking at unrelated contents from the Internet. Under no circumstances should the teacher take the role of an entertainer, but the way of presenting the materials, as well as the materials themselves, should be revised and updated so as to become useful and usable by the 'digital natives'. However, traditional teaching methods should not be subject to disrespect – they should only be adapted according to the new generations' ways of processing information and overall thinking.

In fact, there have been certain interesting strives to reconcile the educational process with the distractors, one of which will be presented in the following section.

III. SOLUTION MODELS

Given the situation presented in the previous section, it comes as no surprise that the young generations need to develop high skills to be able to purposefully use IT. These shall be discussed in this section, in the respective order.

A. Critical thinking and extracting relevant data

One of the basic changes schooling system should introduce is teaching students on critical thinking and extracting relevant from all other unstructured, repetitive and sometimes unreliable or false data. While the safe approach using the official textbooks should remain positive, students should be encouraged to add new information, using the Internet as a source, paying careful attention to quality and reliability of the given data.

In this way, the students would not only expand their range of knowledge about the subject, but also improve the methods of obtaining information. This method is used to an extent in high and university schooling, when students do it conscientiously.

B. Improving literacy using IT

Instead of replacing classical written literature and productive (writing) skills with their shortly-formed electronic parallels, these two 'worlds' could be blended into one, helping students to express themselves in a better way.

Word repositories (dictionaries and thesauri) could be used in a creative way, so instead of help only with the spelling, information technologies could be used to improve writing style and range of vocabulary. Moreover, a way of online collaboration could be introduced between schools, cities and even countries, to allow students to exchange written works and do peer review.

C. Collaboration versus Cheating

Since an average Internet user, according to [2], encounters the same amount of data per day that an average citizen would encounter throughout their entire life in the 17th century, the skill of searching for and manipulating information efficiently should be approached systematically and taught from the early stages of schooling. Memorizing data, on the other hand, should not be neglected, but the school system should be purified from memorizing vast amounts of unusable data.

As stated in the previous section, fast search for information does require skill; continuing the idea on the need for critical thinking from the first subsection, it becomes clear that fast and reliable search should be implemented as a part of school curriculum, cross-sectioning the subjects of Sciences and Arts with the subject of Information Technology.

This could be done by allowing students to use various (reliable and deliberately set false) repositories to search for information necessary to solve a problem, even in collaboration with each other – since this is the way information is used and processed in the business world anyway and therefore should be taught before the students' entering this stage of life.

D. Distractors as Help

Certain very useful movements toward this trend have already been made; for instance, as implemented and presented to the public by [4], a web mapping service was used in several Serbian language lessons to present the itinerary and events from Miloš Crnjanski's 'Seobe', making it much easier for the students to understand the timeline of the book.

Similar creative and even unusual uses can be found for social networks, online services and others, so that they, formerly seen as distractors, can also be used as an educational tool. Collaborative work in the environment familiar to the students should then contribute to the quality and purposefulness of the knowledge gained in this way.

IV. CONCLUSIONS AND RECOMMENDATIONS

The opportunities for learning are numerous and present everywhere. A person can learn from anybody and anything. Information is abundant, and mostly unstructured; the skill of searching for valid information and processing it in a proper way should be developed from the early age on. Therefore, schooling systems should implement this on the account of the pure memorizing information from the static sources like textbooks or teachers' presentations. In this way, information technologies can contribute to the learning process tremendously.

The way in which the information is obtained, processed and stored is significantly different from the ways this was done in the past; this applies not only to the educational systems, but also to the later stages of personal development, i.e. working life. Hence, if prepared timely, the students will not experience shock and lose confidence in their knowledge once they enter the working stage of their life.

The change in the educational system cannot happen overnight, but if approached strategically and with patience, the results shall be visible in several years' time. Given the speed and amount of information being created every day, memorizing them can and should not be expected. In fact, instead of practicing memory solely, the school system should develop students' skills like critical thinking, fast and efficient information search, differentiation between true and false, relevant and irrelevant information and similar. In this way, the knowledge of the future generations will be more applicable and their skills will be improved.

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Examples of fold bifurcation in a one-dimensional systems

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Abstract – In this paper will be analyzed a fold bifurcation (or saddle-node bifurcation) in one-dimensional systems, which depend of one parameter r. The analysis will be made via two examples. The examples will analyze the graphical presentations and bifurcation diagram. Finally, we will show that the models of the examples can be represented in one of the normal forms for a fold bifurcation.

I. INTRODUCTION

The fold bifurcations (or saddle-node bifurcation) in a one-dimensional systems $\dot{x} = f(x,r), x \in R,$ which depend of a parameter $r \in R$ is discussed in mathematical literature as [1], [2], [3], [4], [5], [6], [7], [8].

In the dynamics of the one-dimensional systems $\dot{x} = f(x,r), x \in R, r \in R$ interesting is the behavior on the system in dependence of the parameter $r \in R$. The fixed points in these systems can exist or can disappear and their stability can change. These qualitative changes on the dynamics of the system are called bifurcations and the values for the parameter $r=r_C$ for which comes to these changes are called a bifurcation point. In other words, for $r=r_C$ occurs a bifurcation, if the qualitative changes of the system are different for $r>r_C$ and $r<r_C$. Then the parameter r is called a bifurcation (control) parameter. Usually for presenting a bifurcation, we use a bifurcation diagram, which is the graphical presentation on the dependence of x from r. In other side, for marking the vector field on the line for the differential equations $\dot{x} = f(x,r)$ is the graphical presentation on the dependence of $\dot{x}$ from x where for $\dot{x} > 0$ the arrows of vector field are targeted to the right and for $\dot{x} < 0$ the arrows of vector field are targeted to the left.

In this paper, we will consider two examples of a fold bifurcation that belong to group on the local bifurcations where the change of stability on fixed point is limited to small regions around her in the phase space. Because, a fold bifurcation is defined as a local bifurcation where the two fixed points in continuous dynamical system collide and are destroyed (disappear).

The first example is similar with an example in paper [1] on page 35. The second example is unsolved exercise with the title "Fold bifurcation in ecology" in paper [2] on page 104.

The normal forms of the fold bifurcation for a differential equation that depend on one parameter are $\dot{x} = r + x^2$ (i) and $\dot{x} = r - x^2$ (ii) where r is control parameter, [1], [2], [3], [7]. In (i) for $r < 0$ and in (ii) for $r > 0$ there are two fixed points where one is stable, but another is unstable. In (i) and (ii) for $r = r_c = 0$ the two fixed points collide and appears a fixed point that is semi-stable fixed point. In (i) for $r > 0$ and in (ii) for $r < 0$, there are not fixed points (they disappeared) and the system is unstable. A bifurcation point appears for $r_c = 0$ because in her appears change in behavior of the system where the vector fields for $r < 0$ and $r > 0$ are different.

Close to the fold bifurcation a differential equation which describes the dynamics for one-dimensional system can be reduced to a normal forms (i) or (ii) by [1],[2].

In graphical presentation on the paper, the stable fixed point will be marked with a black point, the unstable fixed point with white point and semi-stable fixed point with the grey point.

II. SIMPLE EXAMPLE FOR A FOLD BIFURCATION

One simple example for a fold bifurcation on a differential equation depending on one control parameter $r \in R$ is

$$\dot{x} = r + x - e^x, x \in R \qquad (1)$$

In this example, the fixed points of the system will be found with the geometric approach, because the differential equation $\dot{x} = 0$ does not have the

explicit solution for $r \in R$. An intersection of the functions $r + x$ and e^x are the fixed points for the system (1), where exist a three cases: intersection in two points, intersection in one point and the functions do not have an intersection. An intersection of the functions is presented in Figure 1 with marked vector field. The arrows of vector field are targeted to the right for $r + x > e^x (\dot{x} > 0)$ and the arrows of vector field are targeted to the left for $r + x < e^x (\dot{x} < 0)$. The two fixed points of the system (1) where x_1 is unstable fixed point and x_2 is stable fixed point are shown also in Figure 1, a). The two fixed points of the system (1) collide and appears one fixed point (semi-stable) $x = 0$ which is shown in Figure 1, b). The system does not have a fixed points and it is unstable, Figure 1, c).

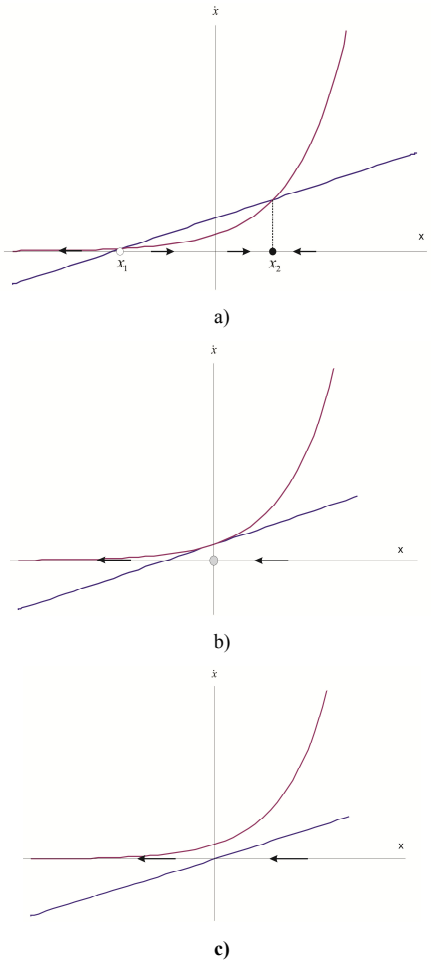


Figure 1. Fold bifurcation for (1)

The fixed point $x = 0$ on the Figure 1, b) is a bifurcation point. This bifurcation point is found analytical with an equation

$$r + x = e^x \Leftrightarrow \frac{d(r+x)}{dx} = \frac{d(e^x)}{dx}$$
$$\Leftrightarrow 1 = e^x \Leftrightarrow x = 0$$

For $x = x^* = 0$ and $\dot{x} = 0$ in the equation (1), we obtained the value for the control parameter $r = r_c = 1$. This value for the control parameter $r = r_c$ is a fold bifurcation for the system (1), because the vectors fields for $r < 1$ and $r > 1$ are different. This can be seen in Figure 1.

To show that the system (1) can be represented in one of the normal forms ((i) or (ii)) given in the introduction we used the development of the function $e^x = 1 + x + \frac{x^2}{2!} + o(x^3)$ in Taylor series (to the third order) in neighborhood of the bifurcation point $x^* = 0$. With using (1), we obtain

$$\dot{x} = r + x - (1 + x + \frac{x^2}{2!} + o(x^3))$$
$$= (r-1) - \frac{x^2}{2} + o(x^3)$$

Really, the differential equation $\dot{x} = (r-1) - \frac{x^2}{2} + o(x^3)$ corresponds with the normal forms mentioned in the introduction.

III. A FOLD BIFURCATION IN ECOLOGY

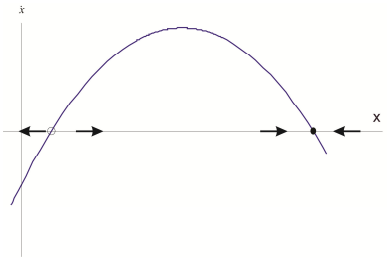
A simple ecological model (as a model for single population) is given with following differential equation

$$\dot{x} = a\,x\,(1 - \frac{x}{K}) - r \quad (2)$$

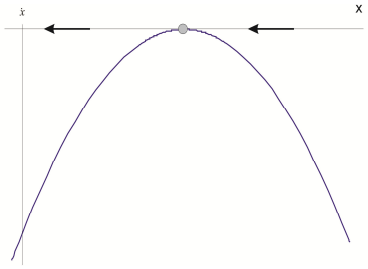
where x(t)>0 is the population number in the time *t*. a is the intrinsic growth rate of the population, K is the carrying capacity of the population and r is the harvest rate as control parameter. We will focus only on the mathematical aspect.

The fixed points are obtained of the equation $\dot{x} = a\,x\,(1 - \frac{x}{K}) - r = 0$. There are three cases: two fixed points, one fixed point and no fixed points. In Figure 2 is marked the fixed point (if there is some) and vector field. The two fixed points of the system (2) where $x_1 = \frac{aK - \sqrt{a^2K^2 - 4aKr}}{2a}$ is unstable fixed point and $x_2 = \frac{aK + \sqrt{a^2K^2 - 4aKr}}{2a}$ is stable fixed point are shown in Figure 2, a). The two fixed points of the system (2) collide and appears one fixed point

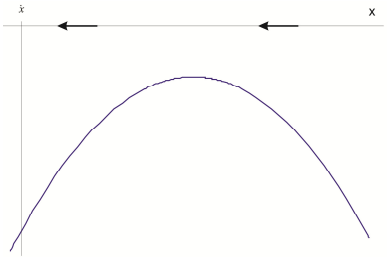
(semi - stable) $x = \frac{K}{2}$ is shown in Figure 2, b). The system does not have a fixed points and it is unstable, Figure 2, c).



a) for $r < r_c$



b) for $r = r_c$

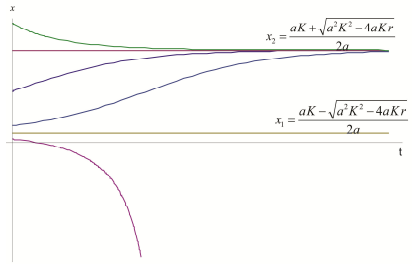


c) for $r > r_c$

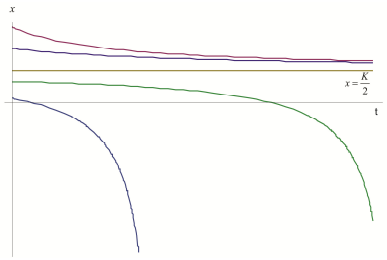
Figure 2. Fold bifurcation for the model (2)

The fixed point $x = \frac{K}{2}$ in Figure 2, b) is a bifurcation point, which will be marked with $x = x^* = \frac{K}{2}$. For $x^* = \frac{K}{2}$ and $\dot{x} = 0$ in the model (2), we obtain the value for the control parameter $r = r_c = \frac{aK}{4}$. This value is a fold bifurcation for the system (2), because the vector field for $r < \frac{aK}{4}$ and $r > \frac{aK}{4}$ are different. This can be seen in Figure 2.

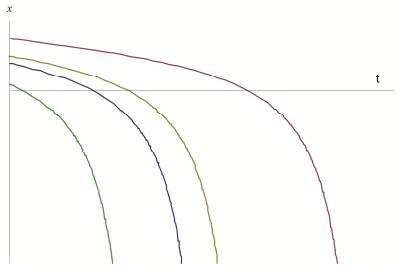
The dependence of x (t) for different initial values for the differential equation (2) is shown in Figure 3. In Figure 3, a) an unstable fixed point x_1 and a stable fixed point x_2 are shown. In Figure 3, b) a semi-stable fixed point (the bifurcation point) $x^* = \frac{K}{2}$ for the values of the control parameter $r_c = \frac{aK}{4}$ with the stable points $x > \frac{K}{2}$ and unstable points $x < \frac{K}{2}$ are shown. Moreover, in Figure 3, c) instability on (2) is shown.



a) for $r < r_c$



b) for $r = r_c$



c) for $r > r_c$

Figure 3. The integral curves ***for*** the model (2)

In Figure 4 are shows a bifurcation diagram for the system (2), which presents depends of x from the control parameter *r*, *x(r)*. For $x > \frac{K}{2}$, the system (2) is stable, for $x < \frac{K}{2}$, the system (2) is unstable and for $x^* = \frac{K}{2}$, x* is a bifurcation point for the values of the control parameter $r_c = \frac{aK}{4}$.

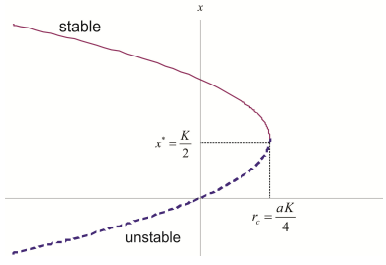


Figure 4. Bifurcation diagram of fold bifurcation for the model (2)

Finally, we come to the following conclusion.

1. When the function has two fixed points then the value of the control parameter is $r < r_c$: If the population $x(t)$ is close to the unstable fixed point x_1 of left then the population $x(t)$ is dying out. If $x(t)$ is close to the unstable fixed point x_1 of right then the population $x(t)$ grows and it is approaching to the stable fixed point x_2. If $x(t)$ is close to the stable fixed point x_2 of right then the population $x(t)$ is reducing and it is approaching to the stable fixed point x_2.

2. When the function has one fixed point then the value of the control parameter is $r = r_c$: If $x(t)$ is close to the semi-stable fixed point $x^* = \frac{K}{2}$ of left then the population $x(t)$ is dying out. If $x(t)$ is close to the semi-stable fixed point $x^* = \frac{K}{2}$ of right then the population $x(t)$ is reducing and it is approaching to the stable fixed point $x^* = \frac{K}{2}$. The point $x^* = \frac{K}{2}$ has maximum value for the population, which depends of the K - the carrying capacity.

3. When the function does not have fixed point then the value of the control parameter is $r > r_c$: The system (2) is instable and the population is dying out.

To show that the system (2) can be represented in one of the normal forms ((i) or (ii)) given in the introduction we used the function $f(x,r) = a\,x(1-\frac{x}{K}) - r$ as a function of two variables x and r. In order to analyze the dynamics of the system (2) in neighborhood of the bifurcation point $x^* = \frac{K}{2}$ and when $r_c = \frac{aK}{4}$, the function $f(x,r)$ is developed in Taylor series (to the third order)

$$\dot{x} = f(x,r) = f(x^*,r_c) + (x-x^*)\frac{\partial f}{\partial x}|_{(x^*,r_c)} + (r-r_c)\frac{\partial f}{\partial r}|_{(x^*,r_c)} + \frac{1}{2}(x-x^*)^2\frac{\partial^2 f}{\partial x^2}|_{(x^*,r_c)} + \ldots$$

where the square member $(r-r_c)$ is discarded. The members $f(x^*,r_c)$ and $\frac{\partial f}{\partial x}|_{(x^*,r_c)}$ are zeros, because the point $x^* = \frac{K}{2}$ is e fixed point and because tangential condition of fold bifurcation, respectively. Really,

$$f(x^*,r_c) = a\,x^*(1-\frac{x^*}{K}) - r_c = 0$$

and $\frac{\partial f}{\partial x}|_{(x^*,r_c)} = a - \frac{2ax^*}{K} = 0$. The other expressions are $\frac{\partial^2 f}{\partial x^2}|_{(x^*,r_c)} = -\frac{2a}{K}$ and $\frac{\partial f}{\partial r}|_{(x^*,r_c)} = -1$ and we obtain

$$\dot{x} = (r-r_c)\frac{\partial f}{\partial r}|_{(x^*,r_c)} + \frac{1}{2}(x-x^*)^2\frac{\partial^2 f}{\partial x^2}|_{(x^*,r_c)} + \ldots = -(r-\frac{aK}{4}) - \frac{a}{K}(x-\frac{K}{2})^2 + \ldots$$

The differential equation

$$\dot{x} = -(r-\frac{aK}{4}) - \frac{a}{K}(x-\frac{K}{2})^2 + \ldots$$

correspond with the normal forms mentioned in the introduction.

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Flood Simulation for Expected Damage Calculation

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Abstract - Rapid growth of the world population, frequent migrations to the unpopulated, hazardous areas and environmental degradation in recent decades, resulted in increased vulnerability of communities exposed to hazards. With the aim of vulnerability reduction, disaster risk managers are making an effort to determine potential consequences that can be caused by various disasters. Therefore, students of Disaster Risk Management and Fire Safety Engineering at the Faculty of Technical Sciences in Novi Sad are trained to determine disaster consequences based on the comprehensive risk analysis. Thus, during practical exercises at the study program, special attention is given to the use of contemporary information technologies for modeling, simulation and visualization of hazardous scenarios. This paper provides a method for determination of expected damage for the residental buildings exposed to flood at the territory of Novi Sad. Quantum GIS software was used for flood simulation and water depth derivation based on which damage for each flooded object was calculated. Students are encouraged to adopt the method during the fifth semester of the studies.

I. INTRODUCTION

Data in the International Disaster Database for the 1995 to 2015 period indicate that flood, with a share of 47%, is the most common hazard caused by meteorological conditions. During this period, 2.3 billion people were affected by floods. [1]

Republic of Serbia was affected by severe flood during the spring of the year 2014. According to the assessment results, the total damage from flooding in 24 municipalities in Serbia, was 1525 million euros. 57 % of total damage (885 million euros) represents the value of the destroyed material property, while 43% (640 million euros) refers to production losses. [2] Taking into account the remaining municipalities affected by the flood, (total number of 38 municipalities), damage from flood amounts 1.7 billion euros, or more than 4% of GDP. [2]

The consequences of the flood in the Republic of Serbia pointed out that the population is highly vulnerable to flood, particularly in socio-economic sense. Vulnerability, as one of the disaster risk component, is necessery to be analysed during disaster risk management process. As vulnerability could be measured only indirectly and retrospectively on the basis of the damage caused by disaster, this paper describes a method for determination of the expected damage from potential flood event. The method is elaborated for the case of residential buildings potentially exposed to flood in Novi Sad. Quantum GIS software was used for the flood simulation, based on which percentage of potential damage in dependance of flood depth was determined. Students of Disaster Risk Management and Fire Safety Engineering at the Faculty of Technical Sciences in Novi Sad are encouraged to adopt described method during the fifth semester of the studies.

II. METHOD FOR THE EXPECTED DAMAGE DETERMINATION

In the global, as well as in the national literature [3, 4] basic components of risk are probability of occurrence and damage. Consequently, flood risk can be defined as the probability of damage occurrence for the observed flood plain area. For the flood risk quantification it is necessary to determine the expected damage for a potentially affected zone. Expected damage determination should be done for the each type of utilisation of the exposed zone (settlement, industry, agriculture, etc.). Case study used for the method verification includes only direct material damage that may occur on property. Accordingly, the term property relates to the residential buildings without an inventory.

In order to determine expected damage it is necessary to determine the following parameters:

maximum damage that may occur at the residential building and the damage factor. The maximum damage that may occur in the case of flood event is equal to the estimated value of the residental building, while damage factor is degree of property damage corelated to the maximum damage that can be realized. Damage factor is expressed as a percentage and it is determined by damage function expressing relationship between the depth of flooding and the value of the flooded property.

Damage factor for residential buildings affected by flood can be determined using damage function, derived by German insurance companies, based on the historical data about flood consequences. [5]:

$$y = 6{,}9 \cdot x + 4{,}9 \qquad (1)$$

where y is a damage factor expressed as a percentage, and x represents the depth of flooding expressed in meters. Function is derived based on the real price of assets.

After price estimation of the residential building (in the case of maximum damage) and the damage factor calculation, by multiplying these two values monetary equivalent of the potential damage is expressed. For the purpose of flood depth determination for each resdential building potentialy exposed to certain flood, in Quantum GIS software three different levels of flood were simulated.

III. FLOOD SIMULATION IN QUANTUM GIS

In order to realize the simulation of flooding using geographic information systems it is necessary to analyze the possibility of flood realization at the territory of interest. If a hazard is defined as the probability that an event of a certain magnitude occurs in a given area within a specified period of time [6], magnitude and return period are parameters necessary for the analysis of flood occurrence. Magnituede and the return period for the

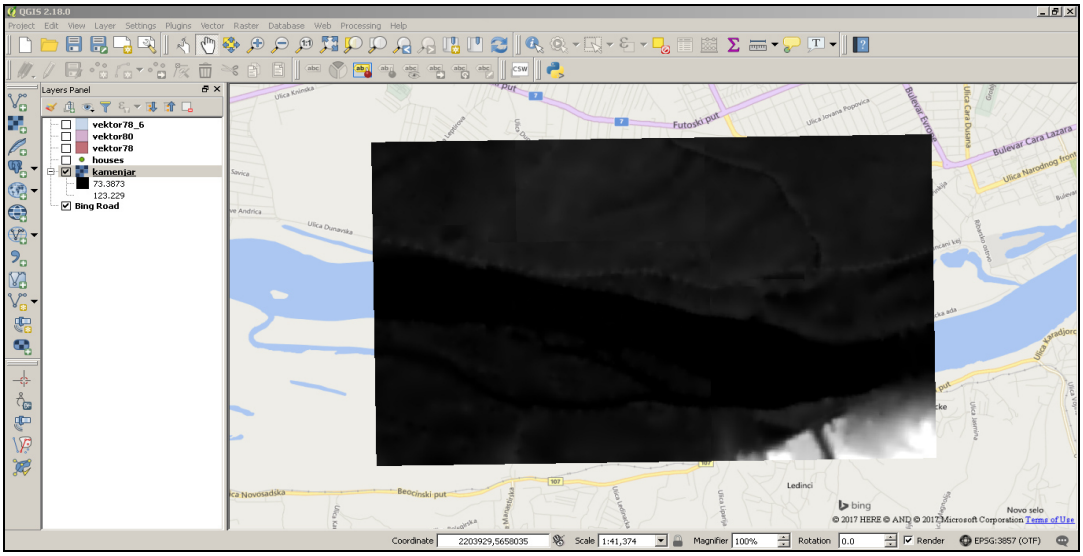

Figure 1. Digital elevation model of Novi Sada loaded into QGIS project

potential flood at territory of Novi Sad were determined based on the historical data about maximum level of Danube for the period from 1919 to 2008 year. Table 1 shows the values of the water level in relation to the sea level for the return periods of 10, 20 and 100 years.

TABLE 1. Water levels of 10-, 20- and 100-years flood[5]

Return period (year)	Annual occurrence probability	Danube water level above the sea level (m)
10	0,1	78
20	0,05	78,6
100	0,01	80

Flood simulation for the three specific occurrence probabilities is realized by Quantum GIS software application. Input data for the flood simulation were digital elevation model of the Novi Sad territory and map of Novi Sad loaded into QGIS using OpenLayers plugin. (Figure 1).

Three vector layers were created based on raster calculation performed on the digital elevaton model for the three characteristic values of water levels. Figures 2, 3 and 4. represent polygons for 10-, 20- and 100-year flood.

Produced polygons of characteristic water levels were input data for the spatial analysis of residential buildings exposure to potential flood. Exposure analysis and flood depth determination were carried out for the residental buildings of the weekend settlement Kamenjar in Novi Sad.

IV. EXAMPLE OF DAMAGE ESTIMATION

Weekend settlement Kamenjar is located in the southwest part of Novi Sad, near the Danube River. Residental buildings are built in the riverbed, which makes them particularly exposed in the case of the flooding. For the purpose of exposure analysis vector layer displaying the houses was created (Figure 5).Then, it was over lapped with 10-, 20- and 100-year flood polygons. It was found that in the case of 20- and 100-year flood all buildings will be flooded, while in the case of 10-year flood 45 facilities out of 461 will be above elevation of 78m.

For the purposes of damage assessment, it is necessary to collect data for any residential building about depth of flooding in relation to the characteristic value of the water level, about age and surface of the object and about the monetary value per square meter of the object. Therefore, to the created vector layer of residential buildings attribute table with the listed data was associated. The depth of flooding is determined by subtracting the altitude of an object from the characteristic value of the water level. Example for the damage evaluation is carried out for a 10-year flood.

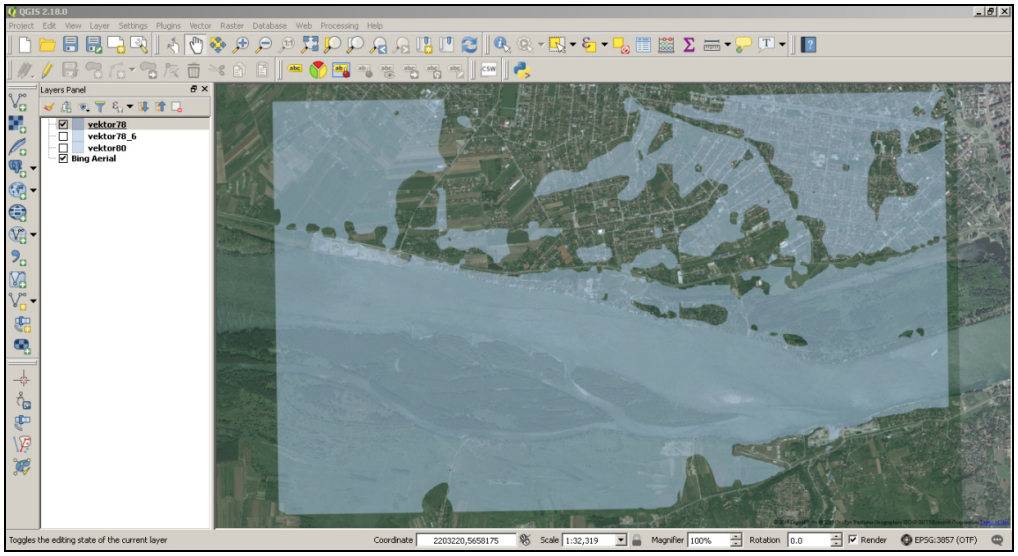

Figure 2. Vector layer for 10-year flood

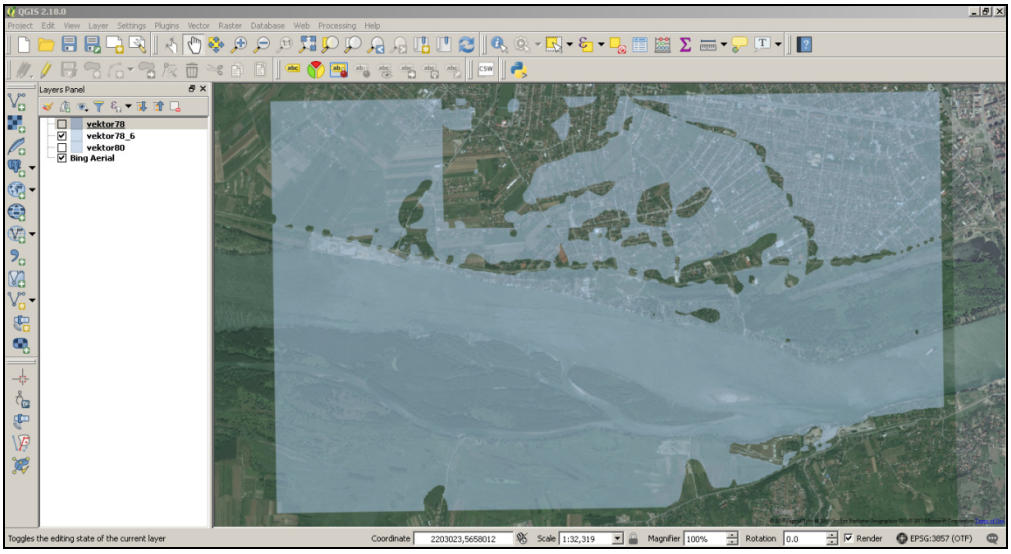

Figure3. Vector layer for 20-year flood

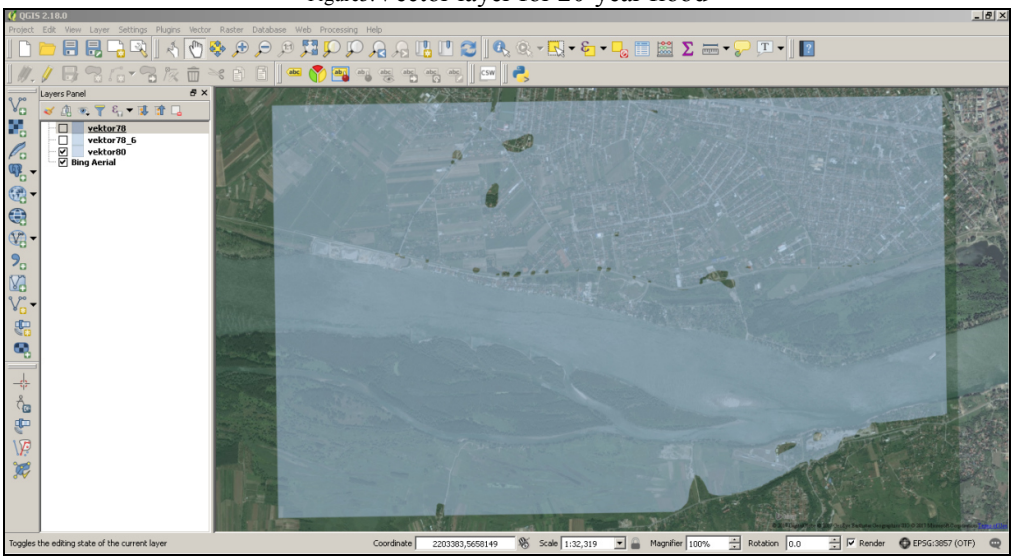

Figure 4. Vector layer for 100-year flood

Figure 5. Vector layer displaying residential buildings at the weekend settlement Kamenjar

For the purpose of potential damage to the building exposed to flood determination, it is necessary to determine the value of the building. The current object value represents the value of new object reduced by a certain amount of amortization.

The value of a new residential buildingis expressed as the floor area (m^2) multiplied by unit price per square meter of the floor area(€/m^2). The average floor area of a residential building in the research area is 40 m^2, while the unit price is 775 euros [7]. Thus, the average value of a new residential building in the weekend settlement Kamenjar is 31000 euros.

Since building of the houses at the Kamenjar started in the late nineties, in this research method residential buildings have been classified into three categories:

1. Average age of residential buildings is 10 years,
2. Average age of residential buildings is 20 years,
3. Average age of residential buildings is 30 years.

According to the Law on Property Taxes [8], amortizatoin rate is in the range from 1% for each year passed since the construction of a house, to the maximum of 40%. Accordingly, corresponding amortization rates for the analyzed types of residential buildings are 10%, 20% and 30%, respectively.

Applying previously elaborated method to assess the direct damage that may occur during the realization of a 10-year flood in a residential building that is 10 years old and is situated at an altitude of 77 m, monetary equivalent of the expected damages will amount 3152.7 €.

Using elaborated method it is possible to determine the expected damage for each residential building affected by any characteristic value of the water level.

V. CONCLUSION

The value of the expected damage calculated in the presented example represents the data necessary for the assessment of communitie's vulnerability to flooding, which is the basis for disaster risk assessment and management. Also, the example of the flood simulation realized for the purposes of expected damage determination confirmed necessity of geoinformation technologies utilization in the field of disaster risk management education.

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Actor Systems in Online Gaming

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Abstract - Designing and implementing distributed systems for online games is hard. This paper outlines an approach, very well known in telecommunication systems, that can be used to simplify design and implementation of distributed game servers. The paper will follow a proof of concept implementation of new distributed game server system.

I. INTRODUCTION

Advancement in cloud computing and prices of cloud services have made distributed computing accessible more the wider programming population than ever before. Still, writing distributed systems is challenging at best. This paper introduces a novel runtime, called Orleans, built by Microsoft Research group, which offers .NET runtime and programming models to allow developers to build systems that scale without having to worry about low level plumbing of a distributed system.

The runtime builds upon the actor model paradigm, used heavily by Erlang language and in telecommunication systems for the past couple of decades.

II. ACTOR SYSTEMS

Actor systems are not new. They were created by C. Hewitt et al. in 1973 [1]. At the time they were created, they represented something completely new. Inspiration for them came from physics (general relativity and quantum mechanics), and they provided a relatively simple but powerful way of building applications that could utilize efficiently all the resources of a single machine, but could seamlessly work across multiple nodes in a cluster. Actors are built as state and behavior into one object, with immutable messages going from one actor instance to another.

All of this would be transparent to the developer of the application, who would rely on the Actor system to take care of distributing the work across nodes, recovering from errors in run-time, and contract the resource usage if the workload decreased. And because of the asynchronous nature of the actor model, the systems built this way would exhibit high level of concurrency.

In the day and age of cloud computing, this now seems to be a perfect framework to build applications that naturally fit in the cloud ecosystem.

This transparency to the developers, allows focusing on the business aspect of the system, instead of trying to master low level details of building a distributed system. Abstraction level that the actor model and its system uses, hides these low-level details intentionally.

A. Online gaming today

With arrival of smart mobile phones, tablets and ultra-portable computers consumers are able to play the games from anywhere, anytime.

This means that the infrastructure that supports the game must be flexible to accommodate peaks and contractions in game usage. It's not unusual to hear that a highly-anticipated game was released, and instead of celebration the team behind it spent first couple of weeks scrambling to handle the scale needed to normally run the game.

Life-cycle of games somehow perfectly matches the outlined benefits of the actor systems:

- Ability to handle peak loads by distributing the work across cluster of actors
- Handle failures in infrastructure gracefully and transparently to the end user
- Efficient usage of the resources at hand (possibly in the 90%+ range)

III. CASE OF ACME SLOTS GAME

In a hypothetical game, called "Acme Slots", we shall use actor system to showcase how can we build a distributed, self-healing game server.

Usually, slot games can be played in a free and cash mode. Free mode, or how I usually call it—"mickey mouse money"—gives a player a fixed amount of money to try out the game, and does not require the player to register with the site. On the other hand, cash mode, requires registration, requires actual transaction via payment provider to be made, to be able to play, and can have side effects that affect other players. Like jackpot contributions from the game stakes.

We'll account for these basic requirements into the system. To keep the system as simple as possible, we are going to forego all other requirements that arise from legislation (e.g. how jackpot distribution works) or operator wishes (e.g. capping the maximum win for a player).

The basic layout of the system would be as shown in the Figure 1.

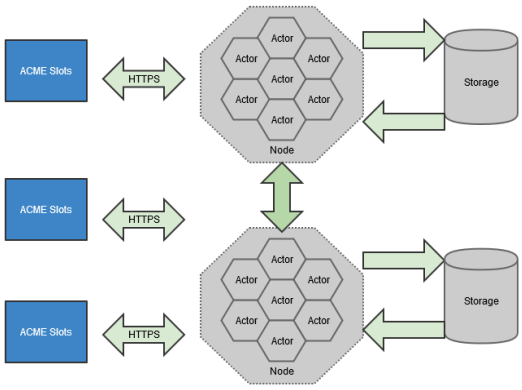

Figure 1: actor system layout

To help us in building the distributed system, we are going to use Orleans framework [2], which provides programmer friendly programming model with somewhat, evolved, actor notion—a virtual actor.

IV. VIRTUAL ACTORS

Orleans has a very good documentation, which explains the virtual actors as:
"Orleans is an implementation of an improved actor model that borrows heavily from Erlang and distributed objects systems, adds static typing, message indirection and actor virtualization, exposing them in an integrated programming model. Whereas Erlang is a pure functional language with its own custom VM, the Orleans programming model directly leverages .NET and its object-oriented capabilities. It provides a framework that makes development of complex distributed applications much easier and make the resulting applications scalable by design".

Because virtual actors are always existing, and the lifetime of such an actor is managed by Orleans run-time, we've accomplished second requirement from our distributed system wish list. Our run-time will take care of moving the actor instances across cluster nodes, if an outage on one node prevents the execution of our virtual actor.

Also, the run-time will handle the resource usage. In case the node that we're about to execute our actor is out of resource (storage, CPU, RAM) the run-time will move the actor instance to a node that can accommodate the request. This will prevent the hot-spots in our cluster, by moving the work in a balanced way. This is our third requirement from the distributed system wish list.

Our first requirement will be fulfilled because of the above, as the workload will balance itself across the cluster—automatically.

V. BACK TO ACME SLOTS

With virtual actors on the scene, we can come back to the game introduced in earlier section, and see how these fit together.

Things to keep in mind:

- message passed around the system are immutable—concurrency 101
- having idempotent actors will ease our lives—retry as much as needed to get the job done
- function shipping and data locality are your friends—data should be in the location where it's supposed to be processed
- database session pooling—common problem when accessing a shared resource in a distributed system, like RDBMS storage, can be solved by introducing a Shard actor, thus benefiting from run-time handling the failure and hot-spot scenarios for us

With these things in mind, we'd go separate the actors in the game to handle the following things:

- router actor—we need to be certain that the actor processing player's requests is

always targeted, to have the benefit of data locality come into play
- authentication actor—security is important; thus, all the requests should be authenticated before processed further.
- player actor—all the stats of the player (balance / wallet, user details etc.) should be handled by this actor
- session actor—during the game session we need to keep all the book keeping here
- statistics actor—we need to keep track of how the games are played, jackpot hits etc.
- jackpot actor—when a jackpot is hit, this actor should give out the payment to the player actor
- shard actor—talking to a shared resource like the RDBMS storage can be tricky in distributed system

These actors come together with asynchronous message passing built in the Orleans framework to create a distributed back-end service, that handles Acme Slot client requests.

VI. PERFORMANCE

Being a hypothetical game, we will show the performance of Orleans run-time as given in the original paper [2]. The framework was tested on a Halo 4 Presence service, which is responsible for keeping track of all active game sessions, their participating players and game status.

The service was tested on a maximum number of 125 servers, with 1 million actors used (Figure 2).

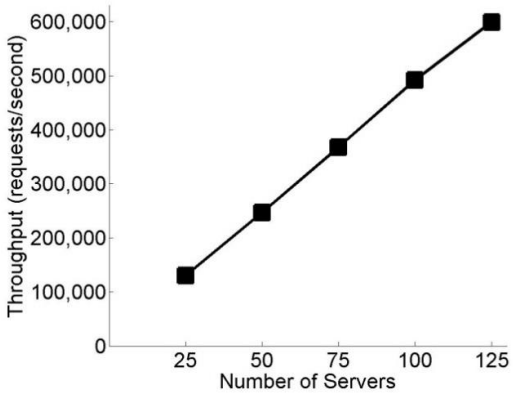

Figure 2: throughput of Halo 4 Presence service

As can be seen, the service itself had almost linear scalability as the number of servers increases.

VII. CONCLUSION

In this paper, a novel approach to already proven paradigm of Actor systems has been shown. The virtual actor and Orleans frees us from building the infrastructure in our applications that takes care of fault tolerance, work distribution and actor management.

The paper showed just a small sample of how this framework can be used. There are many ways the Orleans run-time and the programming model can be used to build new and truly scalable systems.

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The impact of professional development of teachers of technical and information education on the quality of teaching

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Abstract - Professional development at the school level is a continuous process that is planning by teacher and includes various activities being undertaken in the school where they are work. Professional development of teachers is an open, dynamic and ongoing process that involves the transfer of new knowledge from various professional fields and scientific disciplines in the world of practice, as well as monitoring European trends in terms of improving the quality of education. The aim of work is to determine whether teacher training improves the quality of teaching and how it is used in the teaching process. The idea of research relating to the determination of the representation of professional development of teachers in elementary schools, to raise the quality of teaching and improve pupils achievement in their schools.

I. INTRODUCTION

According to Alibabic under professional development means the development of professional competencies after entering the work process. In this respect, the professional development of teachers include professional development through informal methods - in-service training (INSET), formal - master studies, specialist and doctoral studies and the teaching experience [1].

According to [2], part of the professional development is also career development, which is in the educational system of the Republic of Serbia formulated the possibility of promotion to titles, which are set hierarchically. Rules on continuous professional development of teachers, educators and professional associates ("RS Official Gazette" No. 14/2004 and 56/2005) defines that in the course of vocational training teachers, educators and professional associate can to advance the acquisition of titles: pedagogical advisor, senior pedagogical advisor (formerly mentor), senior pedagogical advisor (former trainer) and senior pedagogical advisor (formerly senior pedagogical advisor). Teacher, instructor and associate is entitled to increased salary for acquired title [3].

Professional development is expressed in the desire for quality work, even in the case that teachers no one is watching and does not assess his work. The Guide for the introduction of a class teachers work says that the professional development of employees in education involves constant building quality relationships with themselves and towards the environment and is not limited to a particular situation or just one part of the practice. In this way, teachers are referred to the constant review of lessons learned and realized, that is, the continuous self-evaluation of their own work [4].

II. PROFESSIONAL DEVELOPMENT OF TEACHERS

In order to promote and improve his own work every teacher must take into account their professional development on the basis of which may later introduce innovations in working with pupils, do their lessons and lectures more dynamic, closer to the pupils and motivate them to acquire knowledge and materials and for providing a specific outcome based on the learned.

Teacher, instructor and associate expert are required during five years to collect a minimum of 120 points through training outside the institution, including:

- achieves at least 16 points by attending a form of professional training, which develops professional competencies in narrower areas but teaching and learning, support the development of the child's personality and pupils, communication and cooperation;
- achieves at least 30 points by attending a form of professional development relating to priority areas;

- the remaining points to 120 over five years allocated on a priority basis the institution and their own professional development plan. Teacher, instructor and associate expert achieves at least 100 credits from approved programs and up to 20 points for participation in approved professional conferences, summer and winter schools and vocational and study trips.

Within the full-time teacher and associate has 68 hours per year of various forms of professional training, of which 24 hours is entitled to paid leave from the institution in order to attend the approved programs and professional meetings, and 44 hours of professional development within its development activities. Continuous professional development are achieving by the activities undertaken by the Foundation as part of its development activities and they are:

- Performing of a reputable hours, or activity with the discussion and analysis. • Exposure with professional training with compulsory discussion and analysis (time is calculated by the meeting held by professional organ).
- Review of books, manuals, technical article, magazines and teaching materials in the field of education. • Review of blog, website, post, applet, social networks and other multimedia content;
  • Publication of scientific papers, authorship and co-authorship of the book, manuals, multimedia content, teaching aids ....
- Realization of the research that contributes to the advancement and promotion of educational process.
- Expert visits and study tours defined by development plan of the institution are:
- Realization of projects of educational character of the institution.
- Work with students, interns and volunteers.
- Competitions and festivals.
- Professional groups, associations, offices, branches at the city / municipality that contributes to the advancement and promotion of educational and upbringing process.
- Marketing of the school.
- The work of the working bodies and programs.

For every teacher is very important to preserve evidence of the hours spent on personal and professional development in one place, as well as examples of good practice and other evidence which it considers relevant [5].

III. THE METHODOLOGY OF THE RESEARCH

A.Research problem

In order to improve the teaching and learning process itself and make it more efficient, receptive to pupils, teachers need to continuously develop professionally and developed both within the school and beyond of school. By the professional development, teachers improve themselves, develop knowledge, skills and abilities, developing personal characteristics, and therefore their work. Ensuring the promotion of his professional career, as well as a range of other benefits (functions, titles, material incentives, etc.) For teachers who complete certain training programs opens a wide space for new interests, encouraging their potential, focus on self-evaluation and further professional development.

Since the realization of teacher training are carried through one license, that is legally regulated process of professional advancement teacher, thus it is necessary to explore the imaginary practice and the results confirm the advantages and disadvantages that exist in order to promote the professional development and training of teachers.

In a relationship with the problem we are interested in possibilities and effects of professional training as a segment of professional development of teachers of technical and computer education in nine elementary schools of the municipality Odžaci.

B.Hypothesis

Based on a preset research objectives can be set and the general hypothesis, which states: "Professional development of teachers in the elementary schools of the municipality Odžaci, influence on raising the quality of teaching." From general hypotheses resulting sub-hypothese and they are:

- Teachers have positive attitudes about programs for professional development.
- Programs for training teachers evaluated with good or a very good grade.

C.Population and research sample

The survey was conducted in May 2017 in nine elementary schools of the municipality Odžaci, among employed teachers. The sample consists of 17 teachers of different age, years of service in education and gender.

TABLE 1. Characteristics of the questioned teachers

Elementary schools of Municipality Odžaci									
Level of education		Age			Years of service			Gender	
High	Higher	25-35	35-45	45-60	<10	10-20	20-30	Male	Female
64.7%	35.3	6	6	5	6	5	6	5	12

D.Research methods

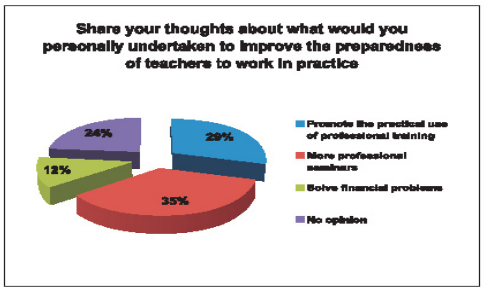
For the purpose of this research is used descriptive method. This method is intended for research of educational practices. After collecting and sorting data, they are compared and interpreted, and then deduced. As research techniques were used interviewing, and as a research instrument was a questionnaire.

The data were obtained through a questionnaire and the answers of the respondents. The data were obtained through a questionnaire and the answers of the respondents. Honesty in responses is achieved with anonymity of the interviewing. The interviewing included questions: closed type, the combined issues, alternative question with the possibility of doubt, the question that asks respondents' answers in response. Also part of the questionnaire contained and descriptive assessment scales.

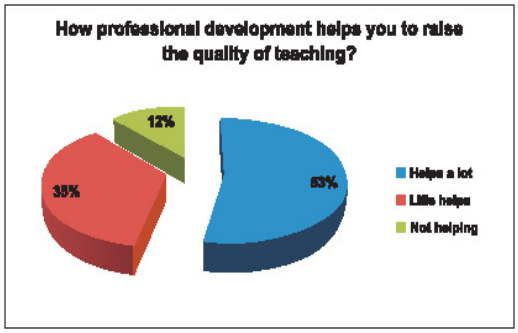
Processing and digitizing the data and calculate results is performed using the software Microsoft Office Excel 2007.

1.Are you enabled continuous professional development? On the first question, 65% of teachers responded that enabled them ongoing training, while 35% of teachers responded that they did not, and the reason they citecited is financial situation.

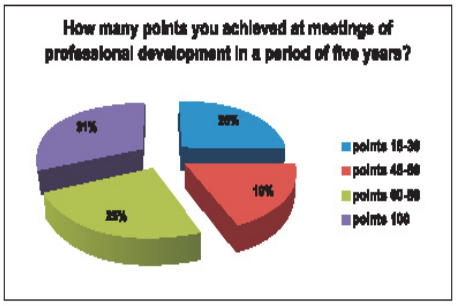
2.Share your thoughts about what would you personally undertaken to improve the preparedness of teachers to work in practice. In the first plan (35%) of teachers has put organizing more seminars. Then (29%) is to encourage the practical applicability of professional training. That have no opinion declared themselves (24%) of teachers. To solve the financial problems in this area was (12%) of teachers.



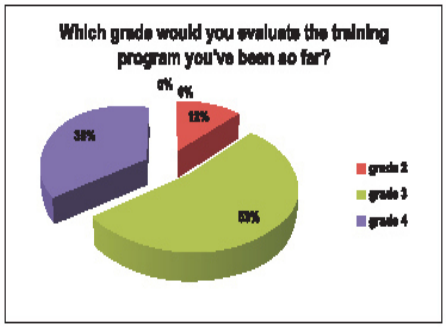
3.How professional development helps you to raise the quality of teaching? The most of them (53%) agree that professional training helps them a lot in improving the quality of teaching, 35% of teachers agreed that little bit helps, while 12% of teachers say they do not help.



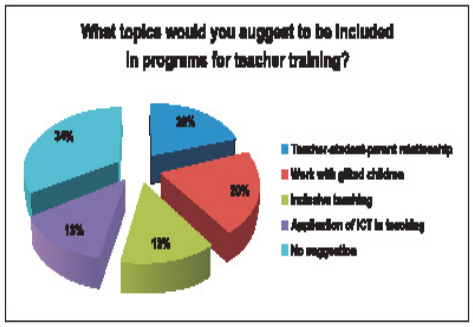
4.How many points you achieved at meetings of professional development in a period of five years? Only 31% of teachers achieved the required number of points in the five-year cycle, 25% of teachers have achieved 15-30 points and 25% of teachers have achieved 60-80 points, and 19% of teachers have achieved 45-60 points. A large number of teachers is not achieved the required number of points in the five-year cycle.



5. Which grade would you evaluate the training program you've been so far? Professional training programs 53% was rated with a score of 3, 12% of the teachers gave a rating of 2, while 35% of the teachers gave a rating of 4. None of the teachers is not a training program where he had been rated a 1, but was not given an estimated 5 . This means that programs of professional education and training satisfy teachers who attended them.



6. What topics would you suggest to be included in programs for teacher training? Most were the teachers who did not have a proposal, they were (34%), followed by (20%) of teachers proposed the theme: "Working with gifted children," as many (20%) of teachers proposed the theme: "The relationship teacher-pupil-parent. The theme:" Inclusive education" was submitted (13%) of teachers, the same number (13%) of teachers proposed the topic "Application of ICT in teaching".



Based on the above displayed responses of teachers can be concluded that professional training have a lot of influence on raising the quality of teaching, teachers also have positive attitudes about programs for their professional development. Themes and programs that deal with professional development seminars for teachers who attended them give them a good and very good grades, which means that they meet the necessary requirements threads are processed.

IV. Conclusion

We can say that our teachers presented a wide range of suggestions how should be improve the system of professional training and practice. Here is primarily on improving the quality of professional development programs addressing the financial problems which would allow more frequent attendance at seminars, seminar in the school, not just a proposal, but also respect for the wishes of teachers in the selection program.

This approach of teachers and their insistence on quality will make their grow into professional training designed and purposeful process of which will have a real gain for themselves and their generations of pupils.

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Review: Using physiological parameters for evaluating User Experience

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Abstract - The study of physiology-based measurement of emotion reactivity for evaluating user experience (UX) has gaining attention in HCI research recently. Physiological methods uses various sensors to measure physiological responses, like: change in skin conductance, changes in heart rate, breathing rate, pupil size, or even brain activity. These physiological methods can be used as alternative to the well-established evaluation methods. This paper summarizes researches done in this area, in recent years. At first, a brief overview of user interfaces, user experience and emotions are given. Then, some physiological parameters (for measuring emotions) that can be used during evaluation are explained. At the end, the methods used by various researchers, for evaluating UX are presented, as well as our next plans in this area of research.

I. INTRODUCTION

User interface (UI) is defined as a set of commands or menus through which a user interacts with an application or a website. It is some kind of connection between users and computer programs [1]. Every application should have easy for use and user friendly interface in order to be used by more people. An application or website with confused and complicate UI is hard to be used and does not have big value [2].

The UI interface is often talked about in conjunction with user experience (UX), which may include the aesthetic appearance of the device, response time and the content that is presented to the user within the context of the user interface [Fig. 1].

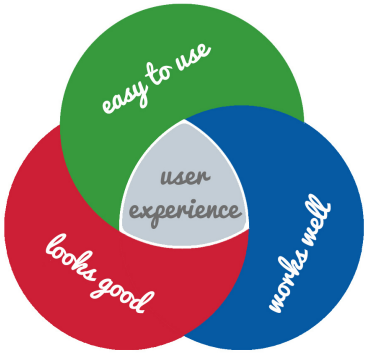

Fig. 1 User Experience

UX refers to the quality of the user's interaction and the perception of the particular product, system or service. It focuses on users understanding - what they need, what they want, what they value, their abilities, and also their limitations [3], [4].

It's important to know that there is a difference between user interface and user experience. An attractive website can have a very good interface, but if it loads slowly or isn't accessible to users on various devices, it's providing a bad user experience. So, creating an effective UI is the starting point for creating a good UX.

One branch of UX research focuses on emotions. This includes momentary experiences during interaction. This arises from the fact that all human behaviors are regulated with nothing else but emotions. But, what are emotions? According to Saberi Roy emotions are probably the most fascinating of all mental processes [5]. Emotions involve two phases of feeling and reaction who are necessarily intertwined. In psychology there is a lot of written about emotions and there are also many theories about it. One of the most influential is James Lange theory, according to which emotion is a perception of states of the body. At first there is a reaction in the body and this reaction creates a feedback, and only then we perceive the emotions according to this theory. Emotions could be positive like love, happiness, empathy, and affection and negative such as anxiety, jealousy,

frustration etc. Our own emotions can help us make sense of every situation. For example, appraisal theory states that our emotions are accompanied by inferences about the situation, or environment, we are in [6].

The amount of research dedicated to assessing emotional responses has grown nowadays [7], [8], [9]. According to Picard [10], the goal of these researches is to design products that will better serve people's needs by recognizing and responding to user emotion. It seems just not enough, today, to design an efficient and effective product interaction that satisfied user requirements. It is also very important to design interactive systems that stimulate or please us aesthetically, psychologically, physiologically, socially, intellectually, etc. Using emotions for evaluating UX is relatively new method that can be used as an alternative to the well established evaluation methods such as questionnaires and interviews. However further research is needed in order to establish these method reliable.
This paper focuses on surveying the recent work done by various researchers for evaluation of UX using physiology sensors to capture human emotion reactivity.

II. PHYSIOLOGICAL MEASURES

Recently there are two major approaches for measuring emotional reactions. The first one is subjective self-reported ratings (through questionnaires) and the second one is objective physiological measurements. We will focus on the last one: objective physiological measurements.

There are a lot of physiological parameters used during evaluation of UX in HCI. Some of them are: heart rate, respiratory rate, body temperature, blood pressure, electrodermal activity (EDA), electroencephalogram (EEG), electromyography (EMG), electrocardiography (ECG) etc. These physiological parameters can be measured by various sensors, attached to human body.

Body temperature

Most of life dependent metabolic processes are sensitive to changes in temperature and for that is important people to have a constant temperature of approximately 37 ◦C. Two types of thermoreceptors send afferent sensory information to the thermoregulation center, deep inside the brain. The thermoreceptors are peripheral - in the skin, convey information about external temperature conditions and internal central thermoreceptors - detect internal changes in the blood temperature [11].

Heart Rate

Heart is part of the cardiovascular system and consist of organs who regulate the blood flow in the body. The cardiovascular system offers many measuring options to determine the arousal. One of that options is Heart Rate (HR). The heart beats faster after beautiful emotion or when we are surprised or stressed and beats slower when everything is ok or in anticipation [12], [13]. Heart beats for about 60 to 80 times in a minute in an average adult. Older people may have it between 60 and 100. There is also a difference between heart rate of a women and a men (heart rate is higher in women than in men).

Pulse

The pulse can be measured manually by palpation with finger tips on a peripheral artery. From this measurement can be deduced: the pulse frequency, which is the number of impulses per minute; the pulse rhythm, which is the cadence of the pulsation, including spaces between pulses; and the pulse quality, i.e., the strength of the pulse, which varies based on the amount of blood leaving the heart (the stroke volume). The pulse cadence is highly dependent on the heart rhythm and changes with innervation of the heart muscles. In addition to the innervation of the heart, the autonomic nervous system has control over the smooth muscles in the vascular walls [11].

Heart rate and pulse rate are often misunderstood as one and the same thing. However, there are some differences between them. The source of a pulse is the heart. The contraction of the heart results in a heart beat. This beat forces blood to pass through the arteries resulting in the formation of pulse. Actually, heart rate, or pulse rate, is the number of times your heart beats per minute and they should be the same, in healthy individual.

Respiratory system

The breathing rate is the second "clock" of the body, in addition to the heart rate. When air is breathed in via the pulmonary artery to the lungs, oxygen flows into the alveoli, from where it is taken up via the capillary bed into the bloodstream. Oxygen, in combination with glucose, is needed primarily for cellmetabolism and maintenance of cell life. In addition, carbon dioxide, which is the waste product of the body's metabolism, is transported via the pulmonary veins and capillary beds to the alveoli and is exhaled from the body. The main function of breathing is to regulate the partial pressures of O2 and CO2 and the pH of the arterial blood [11].

Calm and positive emotions, cause a lower breathing rate, a more regular breathing pattern, and a longer exhalation time than inhalation time, otherwise stress and fight situations cause a higher breathing rate, a more irregular breathing pattern, and a longer inhalation time than exhalation time.

Blood pressure

The pressure exerted by the blood against the walls of the blood vessels, especially the arteries. Blood pressure is characteristically recorded and described as a value pair, the first being the (higher) systolic number and the second being the (lower) diastolic number. It varies with the strength of the heartbeat, the elasticity of the arterial walls, the volume and viscosity of the blood, and a person's health, age, and physical condition. Normal blood pressure is commonly defined as 120/80 mmHg. A repeatedly elevated blood pressure that exceed 140 mmHg over 90 mmHg is defined as high blood pressure (hypertension). A blood pressure reading lower than 90 mmHg for systolic or 60 mm Hg for diastolic is generally considered low blood pressure (hypotension). Blood pressure can change from moment to moment with changes in posture, exercise, stress, or relaxation. Stress and physical activity increase blood pressure, while physical and mental quiescence reduce blood pressure [19].

Electrocardiography (ECG)

An ECG allows the detection of electrocardiac activity, particularly R peaks, and based on these signals, the heart rate can be determined. Heart rhythm changes depending on various internal or external triggers, particularly emotional stimuli. In situations of anxiety, stress, or physical exertion, a SA node firing rate increased as well as transmission velocity of the signal from the SA node to the AV node. As a result the contractile strength and stroke volume increased, that lead to an increased heart rate.

Electrodermal activity (EDA)

When people have physical arousal, sweat is produced in the eccrine glands. The sweat glands changes the electrical conductivity of the skin. Typically for measurement a sweat glands in the palms of the hand or the soles of the feet are used. Measures of EDA are also known as skin conductance levels (SCL) or galvanic skin response (GSR) [12], [13], [14].

Electromyography (EMG)

Electromyography (EMG) is a diagnostic procedure to assess the health of muscles and the nerve cells that control them (motor neurons). Motor neurons transmit electrical signals that cause muscles to contract. EMG measures the electrical activity of muscle during rest, slight contraction and forceful contraction. An EMG translates these signals into graphs, sounds or numerical values that are interpreted by specialist. The test is used to help detect neuromuscular abnormalities [13].

Electroencephalogram (EEG)

An electroencephalogram (EEG) is an electrophysiological monitoring method that measures and records the electrical activity in your brain. Usually it used a small, flat metal discs (electrodes) attached to the scalp. Your brain cells communicate via electrical impulses and are active all the time, even when you're asleep. This activity shows up as wavy lines on an EEG recording. EEG data can be collected by electrode cap placed on user's head (noninvasive method), or by using the electrodes placed on the surface of the brain (invasive method). EEG is most often used to diagnose epilepsy, sleep disorders, coma, encephalopathies, and brain death. EEG sometimes is also used for diagnosis tumors, stroke and other focal brain disorders [20].

III. USING PHYSIOLOGICAL MEASURES FOR UX EVALUATION

Various measurement techniques have been used for measuring physiological parameters, in context of evaluating UX.

Physiological responses caused by emotions should be measured in real-time using various sensors. Sometimes a single sensor is not enough to capture emotional reaction, so a sensor fusion techniques should be used. Bender et al. [14] used this approach in order to predict subjective Self Assessment Maniki (SAM) ratings. Physiological data were collected using EEG, GSR, ECG, and facial tracking. The authors found that it is possible to predict subjective SAM ratings using physiological data measured by various sensors.

Effects of colors on emotions have been studied in [15]. The authors focus on the general effects of hue, saturation, and lightness on the emotions of players, while playing video games. The theory here is that the chromatic stimuli intensity, brightness, and saturation of a video game environment produce an emotional effect on players. Authors have observed a correlation between the RGB (Red, Green, Blue) additives color spaces, HSV (hue, saturation, value), HSL (hue, saturation, lightness), and HSI (hue, saturation, intensity) components of video game images, and the emotional statements expressed in

terms of arousal and valence, recovered in a subjective semantic questionnaire. The results show a significant correlation between luminance, saturation, lightness, and the emotions of joy, sadness, fear, and serenity experienced by participants viewing 24 video game images, and also show strong correlations between the colorimetric diversity, saliency volume, and stimuli conspicuity and the emotions expressed by the players.

Drachen et al. [12] reported a case study on HR and EDA correlations with subjective gameplay experience, testing the feasibility of these measures in commercial game development contexts. Three commercial first person shooter games have been used in this study. The authors expect that this type of game would be ideal for measuring of arousal. Results from this study indicate a significant correlation between measured parameters and self-reported gameplay experience.

Bruun et al. [13] presents a systematic empirical study comparing real-time assertion of emotions and emotions asserted in retrospect through cued-recall. They measured emotions in terms of objective galvanic skin responses (GSR) and subjective Self-Assessment Manikin (SAM) ratings, and found a significant correlations between emotions experienced in real-time and those experienced during cued-recall. The contribution of this paper is the validation of alternative methods for assessing UX.

Forne Malin [16] in her master thesis investigate how physiological measures, such as heart rate, skin conductance and EEG (i.e. electrical brain activity), may be useful in UX and usability testing. The measurement of pupil size, or pupillometry is discussed in more detail. An eye tracking system in combination of infrared light sources and infrared video cameras has been used for measuring the pupil size. When in use, (invisible) near infrared light is pointed to the eye of the user, creating a strong reflection in the retina. These reflections are recorded by the infrared camera, and their relative positions are then used to calculate the point of regard. As eye movements are recorded with an eye tracker, pupil size data is collected in the process. The conclusion is that physiological responses should always be interpreted in relation to the context in which data was collected, as well as to the users' own account of their experience.

Alexander et al. [17] proposed a new tool-based evaluation approach for evaluating UX during HCI. They combined user's physiological signals (e.g. heart rate, blood volume pressure, skin conductance), observation data (e.g. users' face recording, screen recording) and self-reported data (e.g. responses in questionnaires, interviews) in an innovative tool (PhysiOBS) that allows continuous and multiple emotional states analysis. Results from a preliminary evaluation study of the tool were rather encouraging revealing that the proposed approach can provide valuable insights to user experience practitioners.

Börjesson and Jonsson [18] examined how the user experience of mobile games can be evaluated with the use of session recording tools. He also investigates how the user experience can be analyzed from the session recordings, i.e. how the user's emotions can be read from the recorded screen, voice and face. The aim of the thesis was to produce a workflow for user testing with session recording tools for mobile devices.

IV. Conclusion and Future work

Emotions are important in determining users' behavior and the quality of UX. In this article, we offer a glimpse at recent studies in which researchers used various physiological measurements to evaluate emotions. The results from these studies show that physiological measurements may help identify significant episodes of human-computer interaction, which are important for designing interactive systems. However, physiological data should always be interpreted in relation to the context in which it was collected, as well as the subject's own account of the experience.

We would also like to contribute to this field, thus in near future we plan to explore in more details heart rate and respiratory rate as a parameters for evaluation of user experience.

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Improvement of the Assessment Level of Student's ICT Competencies using Triangular Membership Function

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Abstract – The investigation described in this paper deals with the representation of student's knowledge and teaching materials in the domain of intelligent mechanism for assessment level of student knowledge. An approach based on parameterized triangular function is used. While previous experiments were conducted on real-life data for some pretty conservative parameter settings, in this case more liberal setting of the parameters is used. The viability test shows that this is possible and viable solution. It is shown how student's ICT competences are upgraded through triangular membership function parameters variation. Presented solution is a part of larger system based on Mamdani type fuzzy inference mechanism.

I. INTRODUCTION

Rapid developments of the Internet and the Web technologies have facilitated the use of learning objects in Learning Management Systems (LMS). Learners are given access to the same set of learning objects and tools without considering the difference in interest, prior knowledge, experience, motivation and goals [1]. In tutoring system based on traditional system of education, there is no enough time for teacher to properly assess the student's knowledge. Wilson said, "Education commentaries refer to the need for students to develop a repertoire of twenty first century skills and competencies in order to successfully transition from schools to further education and work" [2]. The concepts of competency are synonyms for the basic skills, knowledge, abilities, resourcefulness, and literacy, as well as, and should represent a basis for further learning as part of lifelong learning [3]. The subject of this research is assessing the ICT (Information and Communication Technologies) competencies of the students in order to determine suitable level of knowledge. Due to the long-term interval spent in learning computer training during primary, secondary and self education, the question that imposes itself is how useful it is to include informatics in the curricula. The assumption is that during their previous education students already acquired the ICT competencies necessary for proper participation in the teaching process; therefore, there is no need for an enhancement of students' ICT competencies to a higher level of knowledge. The question that imposes itself in the process of planning informatics lessons is: Should a model of general informatics teaching be adopted or it is better to create a new model of teaching informatics for specific purposes? The following investigation is an attempt to answer this question [4]. The process of developing ICT competencies can prove to be of greater value from the perspective of the already functional methodologies than from learning outcomes or the quantity and quality of the knowledge acquired.

A fact to be also taken into consideration is that students gain part of their informatics knowledge through their own activity (the Internet, Social networks and so on). Knowledge acquired based on a critical and creative transformation of the contents learned will be of greater value than knowledge gained through cognition, reproduction and information gathering [5]. Some informatics contents are harder to acquire as they require reasoning and learning through discovery based on the engagement of various thinking skills and a creative and critical approach to studying informatics-based subjects. In that way, students acquire high quality knowledge which cannot be forgotten, which is easily structured into cognitive schemes, applied, transformed and used in various profession-specific subjects which require the knowledge of informatics. It seems that informatics literacy and the improvement of

students' ICT competencies comprise a unique system. To develop ICT competencies it is important to improve the informatics knowledge, skills and abilities of students. The informatics education can be used for students practice for scientific meetings and promotions. But, using ICT technologies teachers achieve "advanced levels" of efficiency [6]. In the last decade, "Many see technology as a potentially powerful source that is reshaping society and has a potential to do the same in science classrooms" [7]. ICT has lately become an integral part of educational system. It is used as a teacher support in the realization of traditional teaching or as a substitute to such teaching [8]. In the goal of acquiring ICT competences of learners it is necessary to improve their computer knowledge and skills [9]. Development of telecommunications technology and the massive use of the Internet have enabled interactive E- learning based on a systematic approach and the usage of electronic media sources of information [10]. What competencies should students develop during a course of informatics? Should they improve their general ICT competency or should their education rather be based on the informatics competencies for specific purposes? One of the most important preconditions for students to gain specific informatics knowledge is that they have previously gained the basic knowledge of informatics. Students develop informatics literacy during their primary, secondary and self- education.

Students' development of new ICT competencies is quality assessment of students' ICT knowledge. Park said, "By using ICT, a university can provide increased flexibility to student and reach wider audiences beyond the traditional student groups" [11]. With the help of logical reasoning and fuzzy logic tutoring system, it is possible to make a decision on curriculum formation [12]. All in all, the paper deals with conformity check between student and learning materials in order to choose suitable learning content for each individual student.

II. METHOD

The main goal of the process described in this investigation is to determine what teaching content is most suitable for a particular student. This task is necessary since there are many teaching contents which may be delivered to the student. Every student is described by a number of attributes. These attributes are task items, as defined by International Computer Driving License (ICDL) standard. All task items defined by ICDL are used to describe each student. Every teaching contents is also described by multiple task items, but in this case not all task items are used; only task items that describe particular teaching content are used. So, there are m task items that are used to describe each student, while there are n task items to describe each teaching content and $m>n$. In order to determine which content is most suitable for particular student, conformity check algorithm is developed.

The algorithm performs conformity check between student's attributes values and teaching content's attributes values. Main premise for the algorithm execution is that both, student's attributes values and teaching content's attributes values are described by fuzzy membership functions. This means that all attribute values are membership functions. Membership functions [15] are commonly used to define linguistic variables [16] while developing fuzzy logic controllers. This approach was used for intelligent student profiling in an intelligent tutoring systems [17]. In this case triangular membership function *trimf* is used, so that every task item is defined by triangular membership function, regardless of whether that particular task item was used for describing the student or content. This is parameterized function of one argument with parameters a, b and c, see Fig. 1. By altering these parameters one can adjust membership function.

If task item TI is shared by student and teaching content, then student's knowledge of that task item is defined by *trimf* parameterized by a_s, b_s and c_s, while the same task item that is used to describe teaching content is defined by *trimf* parameterized by a_m, b_m and c_m.

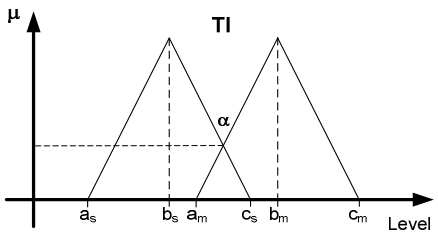

Figure 1. The conformity calculation

The goal of the algorithm is to find the measure of conformity between two triangular membership functions. Two relations have to be satisfied in order to apply this algorithm:

$$b_m > b_s \quad \text{... (1)}$$

$$((a_m > a_s) \wedge (a_m < c_s) \Rightarrow \alpha > 0) \quad \text{... (2)}$$

By satisfying (1) it is ensured that teaching content delivers competencies that are of higher level than current student's knowledge of TI. By satisfying (2) it is ensured that there is the intersection between two triangular membership functions, which also means that alpha is greater than zero. Here, alpha is a measure of conformity between student and learning material, but for actual task item TI. By satisfying both (1) and (2) it is ensured that student is able to upgrade his/her competencies in an optimal rate.

Actual upgrade of student's competencies regarding TI is done by teaching content deliverance followed by test execution. The upgrade is done by altering parameters a_s, b_s and c_s in a following manner:

$a_s = a_s \mid \Delta a_s,\ b_s = b_s \mid \Delta b_s,\ c_s = c_s \mid \Delta c_s$, so that

$$\Delta a_s = (a_m - a_s)t,\ \Delta b_s = (b_m - b_s)t,\ \Delta c_s = (c_m - c_s)t \quad \text{... (3)}$$

In (3), $t \in [0, 1]$ is a test output constant which value is based on test results and "=" is the assignment operator. If student's test results are maximal then $t=1$ and $a_s=a_m$, $b_s=b_m$, $c_s=c_m$, so student's competences are upgraded to maximal level of learning material. If $t<1$, then student's competences are upgraded according to test result but a new level of competences does not reach the maximum level that teaching content allows.

III. VIABILITY TEST

It is necessary to perform the viability test of conformity check algorithm presented theoretically in previous section. This was done by generating some data in Java/Eclipse environment, and applying the conformity check algorithm. The test is aimed at parameterized membership functions of student and material, so that parameters a, b and c of the *trimf* functions are varied for some shared task item.

In order to preserve properties of triangular membership functions following relations must be satisfied: $a<=b<=c$ for both membership functions. In order to preserve an increase of student's competences regarding some task item, following must be satisfied: $b_m>b_s$. Very important relation is: $a_m<c_s$ which means that two membership functions are overlapping so that alpha is greater than zero, see Fig 1. At last, in order to preserve the increase of student's competences following must be satisfied: $c_m>c_s$. Having in mind that it is possible that $a_m<a_s$, and all previously described constraints, some random triangular membership functions are generated for student as well as for learning material and conformity check algorithm is performed, see Table I.

TABLE I. Viability test data

Parameters / Case	Student	Teaching Material	Test results			
	(a_s,b_s,c_s)	(a_m,b_m,c_m)	(a_s,b_s,c_s), $t=0.1$	(a_s,b_s,c_s), $t=0.5$	(a_s,b_s,c_s), $t=0.8$	(a_s,b_s,c_s), $t=1$
1	(37,42,69)	(12,62,75)	(34.5,44.0,69.6)	(24.5,52.0,72.0)	(17.0,58.0,73.8)	(12.0,62.0,75.0)
2	(13,25,50)	(9,27,61)	(12.6,25.2,51.1)	(11.0,26.0,55.5)	(9.8,26.6,58.8)	(9.0,27.0,61.0)
3	(19,78,92)	(30,95,98)	(20.1,79.7,92.6)	(24.5,86.5,95.0)	(27.8,91.6,96.8)	(30.0,95.0,98.0)
4	(9,39,45)	(3,53,61)	(8.4,40.4,46.6)	(6.0,46.0,53.0)	(4.2,50.2,57.8)	(3.0,53.0,61.0)
5	(9,19,79)	(43,91,93)	(12.4,26.2,80.4)	(26.0,55.0,86.0)	(36.2,76.6,90.2)	(43.0,91.0,93.0)
6	(41,81,86)	(26,86,95)	(39.5,81.5,86.9)	(33.5,83.5,90.5)	(29.0,85.0,93.2)	(26.0,86.0,95.0)
7	(59,63,64)	(24,73,76)	(55.5,64.0,65.2)	(41.5,68.0,70.0)	(31.0,71.0,73.6)	(24.0,73.0,76.0)
8	(30,30,58)	(43,77,91)	(31.3,34.7,61.3)	(36.5,53.5,74.5)	(40.4,67.6,84.4)	(43.0,77.0,91.0)

The data are validated for various test results: $t=0.1$, $t=0.5$, $t=0.8$ and $t=1$. The increase of competence is evident: parameter b_s is increased for every t. Although previous tests conducted earlier on real-life data were performed for $b-a= c-b$, in this case there is no such constrain. It is evident from case 4 that $a_m<a_s$, so that parameter a_s is actually decreasing while competence is increasing. This means that student is capable to comprehend particular task item in more "extensive" way. Case 5 gives insight to competence increase level when $b_m>a_m$: in such case the increase is massive, while

Case 6 gives an insight to the situation when $b_m \approx b_s$, so that increase is small.

IV. CONCLUSIONS

Various types of the assessment levels of student's knowledge are in use in everyday practice in the domain of education. Some of them are pretty simple in their structure, but some of them have some inference mechanism for assessing level of student's knowledge in order to implement so called "intelligent" behavior. In this case, intelligent mechanism which estimates level of student's ICT competencies is based on Mamdani type inference engine, so there are inputs and outputs fuzzy variables and fuzzy rules. Besides that, there is a simple mechanism for conformity check between student and teaching material.

This algorithm selects teaching content that is most suitable for student. Both, learning materials and student "insight" to certain item are presented via triangular membership function. So, there are multiple teaching materials compared to a single "insight" value on student's side. After conformity check, teaching material deliverance and the test, student "insight" to a certain item is changed; this change is applied via parameterized triangular membership function, so that parameters are changed in a consistent way described in previous section. It is possible to draw some conclusions:

- while student's competences are increasing, it is possible that his or her "insight" to a certain item is broader, this is represented by decreasing parameter a of the student's triangular membership function which reflects his or her "insight" to certain item,
- big increase of student's knowledge is possible for certain parameters of triangular membership function,
- small increase of student's knowledge is possible for certain parameters of triangular membership function.

By validity test it is shown that this kind of student competence upgrade is possible. Although this mechanism was previously tested on real-life data for conservative parameter setups, in this case test was conducted on generated data for more liberal choice of triangular membership function parameters. Future work will include similar test on real-life data.

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Preschool Childrens' Experiences with Computers: a Case Study

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Abstract – This paper presents a research about preschool childrens' experiences with computers – hardware and software (particularly web applications and Internet). It was conducted with presentation and questionnaire, in preschool institution in Zrenjanin, Serbia. Results show that children have appropriate knowledge of basic hardware modules and some types of Internet-based software, based on their previous experiences at home.

I. INTRODUCTION

Including information and communication technologies in early childhood education has shown potentials in children's development. Some of potential use areas include [1]: support to children's ICT (information and communication technology) literacy and capacity development, language development, mathematical thinking and problem-solving development, support to children from diverse cultural or language backgrounds, support children with special learning needs, as well as support to childhood education centers (in document and data archiving and sharing, institution networking) and support to early childhood teachers (professional education, knowledge sharing, communication with parents or caregivers etc.).

This paper aim is to present a case study in research of preschool children experiences with computers. The case study presents data collected from analysis of questionnaires conducted with a group of 20 children in preschool institution Zrenjanin, Serbia. The paper is organized in sections: related work, research methodology, results, and conclusion.

II. RELATED WORK

The role and possible positive potentials and methods of using computers and generally ICT (information and communication technologies) within early childhood education and preschools has been examined in various research conduction - from Ministry level [1], to university academic [2] and scientific level [3].

The using ICT in early childhood education system has multiple dimensions such as administrative support with educational information systems, to support of teacher professional development and teamwork, as well as cooperation with parents.

The most important aspect of ICT integration in early childhood education institutions, i.e. preschool institutions is support to educational process with children. Some of the related research includes computer-assisted instruction for preschool education [4] and computer-based testing with young children [5]. Some specific aspects of including in educational process are developed for particular educational content, such as mathematics [6].

Particular technology aspect of educational process in early childhood education is examined with general digital media usage, i.e. impact of digital media to learning process of preschool children [7]. Some more precise research include particular type of technology i.e. devices usage within preschools, such as iPad [8].

General conclusion from related work is that using ICT in early childhood and preschool education has much positive potential. Since young children are using ICT in everyday activities at home, it is important to adjust educational technology in early childhood to using ICT from children and their teachers, in aim to "have more enjoyable learning experiences and to connect their learning to their interests, needs and culture" [8].

III. RESEARCH METHODOLOGY

A. Research objectives and hypotheses

Research objective is to determine what is the level of ICT related knowledge of preschool children, based on their previous experiences at home. ICT related knowledge is determined in hardware and software aspect.

Main hypothesis is that preschool children have appropriate knowledge of ICT because of their exposure to computers at home, i.e. because of their experiences.

Second hypothesis is that preschool children are interested to learn and experience using computers.

B. *Research methods*

Research population consists of 22 children in age of 6 (preschool age) that are educated within preschool institution (childhood educational center) in Zrenjanin, Serbia. The research is conduced within "Parents occupation presentation" programme, which was organized on 4th May 2017 in children's room of "preschoolers" within childhood educational center (i.e. preschool institution). According to previously explained research objectives, research was conducted within 3 steps:

1. Determination of basic ICT related terms definitions knowledge within an interactive talk with children about the meaning of ICT related words (to determine ICT related knowledge of terms).
2. Presentation and explanation of hardware and software elements and examples, as well as interaction with a computer.
3. Questionnaire/testing conducting, to determine knowledge at images-recognition level.

C. *Research material*

In aim to enable research methods application, certain materials are prepared and used within the "presentation and testing" time at the preschool institution.

1. For the presentation particular hardware modules were selected and presented to children, as well as their purpose and interconnection was explained.
2. For the testing purpose, questionnaire/test was prepared. The structure of the test was selected to be simple, with only images (since some children from the group were unable to read texts) representing hardware modules/parts and logos of most used software. Selection of hardware is made according to the average computer user of preschool age, as well as the most used software. Content of the test was evaluated with a 6-year old child that belongs to the family of the parents that were involved in the presentation and research.

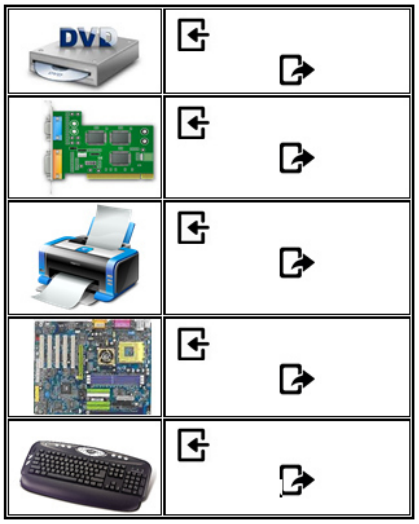

Figure 1. First question page in test

First test page consists of table with two columns. First column have hardware parts/modules and second columns have two symbols – inner part or outer (visible) part of computer (Figure 1). Children had to round off the symbol, in aim to present if the part is inner or outer.

Figure. 2. Second question page in test

Second test page (Figure 2) consists of two columns of images. First (left) column consist of computer hardware parts, while second column (right) consist of human body parts. Children had to interconnect these

Figure 3. Third question page in test

two – each computer part is connected with one or more body parts.

Third test page (Figure 3) consists of table with two columns. First column represent logos of most used software and second column presents small images/icons for particular types of software purpose. Children had to round off the symbol representing the purpose of the appropriate software.

IV. PRESENTATION RESULTS

A. Talk results analysis

Within initial talk, children were asked (Figure 4) to answer about the definition of basic terms of computer usage, parts (which were shortly demonstrated) and software. Interactive answers were given spontaneously by 6 male children, while other children were quietly listening with interest, but did not answer questions.

B. Presentation results

Within the presentation part, hardware modules/parts and their interconnection (Figure 4) were presented and described.

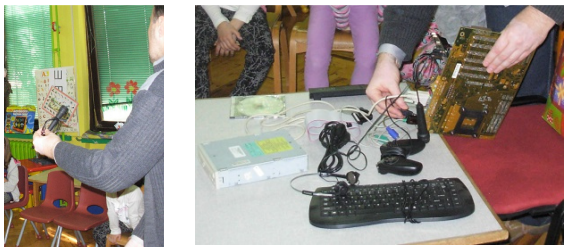

Figure 4. Demonstration and hardware parts interconnection presentation

Whole computer (laptop) as well as software (drawing tool) presentation was demonstrated (Figure 5). Interaction of children with laptop and drawing software tool was enabled and all children were very interested and active, trying to see and experience all available options in software.

Figure 5. Laptop and software presentation

C. Testing organization and population analysis

At the beginning of testing, all test questions were explained (Figure 6) as how to answer them. After short explanation, children rounded the answers (images that they consider the most appropriate answer to particular question).

Figure 6. Test answering short explanation

Within the population of 22 children that were present at the presentation and testing, there were:

- One child that was included in pre-testing that was conducted in evaluation and correction of the test that will be given to other children.
- One child that was present at the presentation and testing, but did not do testing.
- Regular testing population consists of 20 children.

V. TESTING RESULTS

A. Previous computer experiences and interests

Within the regular testing, there were questions such is if they have a computer at home and are they interested of becoming a programmer. The results are:

- 89% of children that claimed that they have computer at home.
- 79% of children claimed that they are interested to be programmers and create computer programs and games.

B. Hardware and software experiences and knowledge

Within the questionnaire/test, there were questions regarding hardware and software recognition. Average results are:

- 84% correct answers regarding hardware, i.e.
  - 83% correct answers regarding position of hardware part (in, out or both).
  - 85% correct answers regarding hardware usage (linking human body parts with hardware modules).
- 62% correct answers regarding software purpose categorization.

Table I and Figure 7 presents testing results in hardware recognition.

TABLE I. TESTING RESULTS - HARDWARE RECOGNITION

Computer part	Number of correct answers	Correct answers Percentage
DVD	21	100%
Audio card	18	86%
Printer	16	76%
Motherboard	19	90%
Keyboard	17	81%
Microphone	21	100%
Mouse	19	90%
Monitor	16	76%
Speakers	20	95%

According to testing results regarding hardware, the most recognizable hardware part is DVD, speakers and microphone. The least recognizable computer part is printer and monitor.

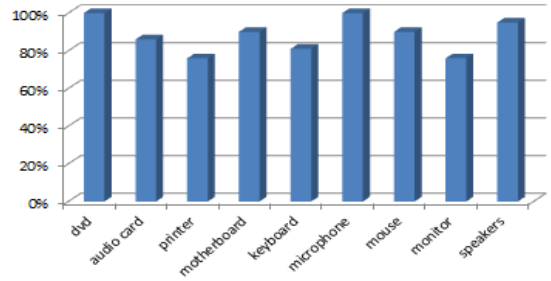

Figure 7. Test statistics - hardware recognition

This leads to conclusion that children had the experiences related to music, while printing did not experience. An "old-fashioned" computer monitor was simply out of their sight, because of possibility that they have laptops and tablets at home and did not have opportunity to see computer monitor as a separate device.

The results of testing in software experiences are presented in Table II and graph at Figure8.

TABLE II. RESULTS OF TESTING – SOFTWARE LOGO RECOGNITION

Software	Number of correct answers	Percentage
www.friv.com	19.5	93%
www.kizi.com	16.5	79%
Minecraft	16.5	79%
Facebook	13	62%
Windows	5	24%
YouTube	12	57%
Google	12	57%
Google Chrome	12	57%

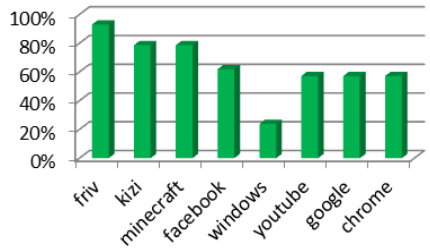

Figure 8. Test statistics – software usage recognition

In software category (Table II, Figure 8), the types of software were selected as probably the most used types of software, according to previous talk with a child that was included in test creating. The selected software include web-based computer gaming portals (www.friv.com and www.kizi.com), as well as computer game Minecraft, social network Facebook, Windows as operating system, YouTube as source of videos and Google/Google Chrome as usual tool for searching for data.

As expected, computer games were the most recognized type of software. Social networks, web browsers and YouTube were at second level. The lowest level of recognition is related to operating system Windows. Obviously, children do not perceive operating system, but they are focused on software of their interest.

VI. CONCLUSION

This paper presents a research conducted in aim to determine experiences of preschool children with computers. Experiences in this research include two periods: 1) experiences with using computers at home, 2) experiences during presentation of computer parts and software, within this research conducting time period.

Large majority of children in the research population answered that they have computers at home. High percentage of children, from research population, was able to recognize computer parts by location/visibility (inner or outer part) and by purpose. Certain most common used software (computer games, internet browsers and video players) were easily recognized by the logo of these web applications.

During the research, preschool children expressed great interest in learning about computer architecture and principles of functioning, as well as interest to use and explore different creative-oriented software. Most of tested children expressed their interest for further education in the programming field, especially for game programming.

Future research in this field could be directed towards exploration of software tools designed for children creative work and research on the responses and suitability for different children age. Other research could lead towards including children in creating educational software for other children.

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Information Technology in the Education System

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Abstract – Goal of this paper is to show the position of information technology in the education system. The paper analyses the development of education with the use of information technology. It is based on a survey in which 100 4th graders from Zrenjanin Grammar School participated in. The first point of this paper shows the general interest of youth in information technology, while the other point is the position of women in the information technology sector.

I. INTRODUCTION

In this day and age we are expected to follow the new daily technological advances. To keep up with the times, we try to gather as much information as we can during lectures or on our own.

It is expected from everyone to have plenty of knowledge and comprehension in this area, but survey will show us if the conditions in schools are good enough to fulfill this role.

It is generally known that the school subject Technical and Informational education (TIE) has the task to presents the technical and informational culture to students, but also to train him to use computers for work and in everyday life.

A lot of advancements are expected in the learning conditions for Technical and Informational sciences because this sector changes every day and higher criteria are set.

This paper analyses the advancement of the quality of subjects in schools, which are based on information technology. It analyses a survey in which 100 4th grade students of Zrenjanin Grammar School participated.

The first point of interest is about the interest of students in information technology and related subjects, the working conditions and the general knowledge of information technology. The second point of interest is the ration between males and females interested in this area. The purpose of this analysis is to point to a needed modernization and advancement in the educational system.

II. INFORMATION TECHNOLOGY IN EDUCATION

Amanda Lenhart [3] conducted a research about how much do students in America, between the age of 13 and 17, use the internet and which applications are mostly used. A total of 1060 students took part in her survey, of which 92% used the internet daily and 24% of them constantly connected. Over half of them, 56% to be precise, use the internet a couple times per day and 12% uses the internet only once per day. Only 6% use the internet once a week, and 2% rarely use it. (Figure 1)

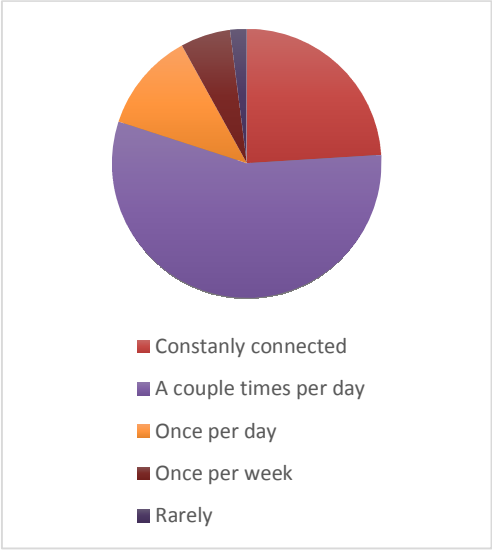

Figure 1. Percentage of time spent online [3]

Base on Lenhart's [3] research we can conclude that the internet plays and important role in the lives of America's youth.

The three most used applications among the youth are Facebook (72%), Instagram (52%) and

Snapchat (41%). (Note: Some of the students use more than one application)

As we can see from the mentioned research, most students use the internet for entertainment and communication with other people. Research about how many students use the internet to further their knowledge and to inform themselves about new technologies wasn't conducted.

Research has shown that a large number of schools around the world added new areas in the education system using information technology. The results are best visible in subjects related to math, where it simplified a large number of units. Students claimed that they've learned more about the principle of information technology during math lectures than during TIE lectures. [1]

From a PISO [4] test conducted in 2012 it was concluded that schools which incorporated information technology in math lectures gave better results than the ones that didn't. A total of 67 countries took part in the PISO test, among which was also Serbia. During the test, students took math, reading and science exams. All the countries created the test by suggesting questions, which were then analyzed and a selected comity chose the questions. The first PISO test happened in the year 2000, in which 32 countries participated. PISO test allows a realistic comparison between countries in different educational area and strengthens the educational policies.

In Serbia this type of education still isn't widely accepted but recently a large number of private schools that teach information technology started opening. They mostly educate the older population about information technology and the basics of using a computer to make work easier. But there are also schools for students that want to further their knowledge in this area.

III. RESEARCH METHODOLOGY

A. *Problem of the research*

Achievements of information technology are no longer unknown to most of the world. Technology accelerates the processes of lecturing and learning by providing better working conditions. By using appropriate technical means it is possible to motivate students, but also to follow the individual progress of students.

B. *Subject of the research*

Subject of this research is to see the interest of 4th grade students from Zrenjanin Grammar School in information technology and technology in general. Furthermore, this research explores their knowledge about the subject, analyses the learning conditions in the school and delves into the ratio between males and females that are interested in information technology.

The purpose of this theoretical analysis and the conducted research is to point to the current knowledge and interest of students for information technology, but also to point out the need for modernization.

C. *Goals and tasks of the research*

The main goal of this research is to establish the basic knowledge of a student about why one should pick information technology and to see the interest of students for this area. The idea behind the research is to see the number of available resources for increasing the average knowledge and interest in information technology.

Other goals and tasks of this research are:

- Advancing the role of information technology in education.
- Getting a higher tier of knowledge about information technology for every student
- Increasing the popularity of information technology among the female students.

D. *Methodological procedure*

This paper theoretically explores the pre-established scientifically-theoretical knowledge, relative literature and modern work practice about using basic analytical and synthetic methods: deduction, analysis, synthesis, generalization and concretization. This research was conducted using surveys and scaling as a descriptive method of gathering information. The survey was made out of queries in form of a questionnaire. The research was operational and experimental and a descriptive method was used to gather information about pedagogical occurrences. The experimental research was conducted using the technic of surveying using questionnaires.

E. *Research hypothesis*

The main hypothesis of the research is: 4th grade students of Zrenjanin Grammar School deem that their school doesn't have the needed lecturing resources for Technical and Informational education (TIE).

Side hypothesis are:

- The TIE classroom in Zrenjanin Grammar School doesn't have the necessary equipment and the

equipment that is present isn't used in everyday lecturing.

- 4th grade students of Zrenjanin Grammar School don't have satisfactory knowledge and interest in information technology.

F. *Research sample*

Out of 1292 students in 42 classes in Zrenjanin Grammar School, 100 4th grade students took part in this survey.

G. *Research design*

The survey was conducted anonymously during school hours. The first part was done in January, 2017, while the second part took place in May, 2017.

IV. SURVEY ANALYSIS

A. *Part one of the survey*

1) 1. Should you engage in information technology?

- The students were given a choice between YES and NO.
- The results showed that 100% of the students answered with YES.
- All of the students think that information technology is useful. (Figure 2)

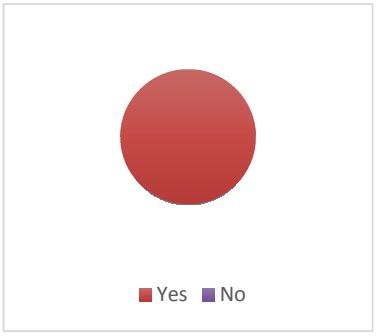

Figure 2. Graph of the first question results.

2) Why should you engage in information technology?

- The students were given a blank space to write down their answer.
- Results showed that 56% of the students wrote down an answer, while 44% didn't fill in the blank space or wrote "I don't know". (Figure 3)
- The 56% had mostly the same reasons; they think that you should engage information technology because it provides financial stability, helps with the development of society, or because it's used in everyday life.

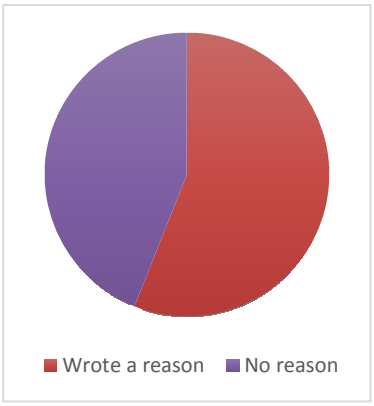

Figure 3. Graph of the second question results.

3) Is information technology needed in our country (Serbia)?

- Students were given a scale, going from 1 (they aren't needed at all) to 5(they are needed very much).
- The results showed that: 2% of students think that it isn't needed (number 1), 10% think that it might be needed (number 3), 50% think that it is needed (number 4) and 38% of the surveyed students think that information technology is very much needed in our country.
- Most of the students think that information technology is needed in our country, while only a handful think that it isn't needed at all. (Figure 4)

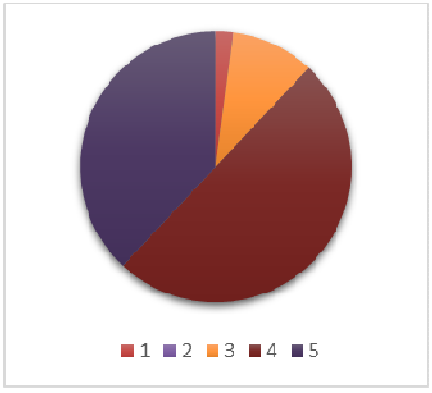

Figure 4. Graph of the third question results.

4) Can you learn how to corectly do a job in information technology without going to faculty/university?

- The students were given a choice between YES and NO.
- Results showed that 72% of students think that this is a job you can do without the need of higher education, while 28% think that you need a higher form of education for working in the information technology sector. (Figure 5)

Figure 5. Graph of the fourth question results.

5) Do you want to choose information technology as a career path?

- The students were given a choice between YES and NO.
- The results showed that 58% would want to select it as a career path, while 42% wouldn't.
- The survey results were much lower than we originally expected them to be. (Figure 6)

Figure 6. Graph of the fifth question results.

6) How much do you know about information technology?

- Students were given a scale ranging from 0 (I'm not interested) to 5 (I inform myself in my free time about information technology).
- Results showed that 8% of the students weren't interested at all(number 1), 8% rated their knowledge/interest with 1, 36% answered with 2, 27% answered with 3, 27% said they have an alright knowledge about the subject (number 4) while only 6% answered that they spend their free time informing themselves (number 5).
- The amount of students that are interested enough to spend their free time exploring information technology is much lower than expected, while the amount that said they had basic knowledge in the subject is higher than expected. (Figure 7)

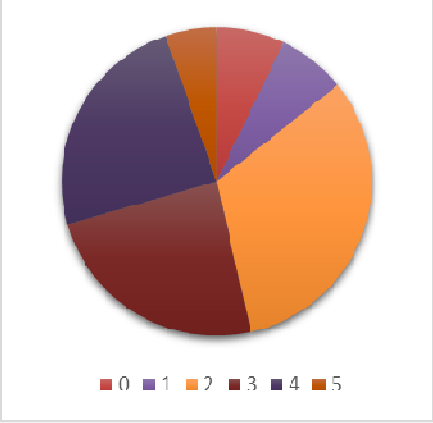

Figure 7. Graph of the sixth question results.

7) Does Zrenjanin Grammar School need an "Information Technology" course?

- The students were given a choice between YES and NO.
- Results showed that 78% think that Zrenjanin Grammar School could use an Information Technology course alongside the three existing courses, while 22% of students answered that this course isn't needed.
- Students showed interest for development of information technology in Zrenjanin Grammar School. (Figure 8)

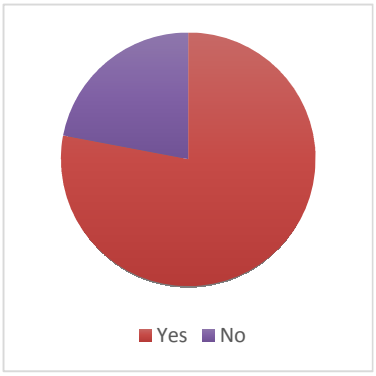

Figure 8. Graph of the seventh question results.

8) Does Zrenjanin Grammar School have the necessary conditions to open a information technology course?

- The students were given a choice between YES and NO.
- Results showed that 22% think that the conditions in Zrenjanin Grammar School are good enough for the course, while 78% think that Zrenjanin Grammar School lacks the necessary resources and conditions to suffice an information technology course.
- The students are best aware of the conditions in their school and they think that Zrenjanin Grammar School isn't a good candidate for an information technology course. (Figure 9)

Figure 9. Graph of the eight question results.

Part one of the survey tells us that students of Zrenjanin Grammar School have basic knowledge about information technology.

We can conclude that interest for information technology isn't high, but there potential for improving the education in Zrenjanin Grammar School.

Most students think that the school doesn't meet the necessary working conditions and present that as the biggest problem.

Improvement of working conditions can give better progress of information technology in education.

B. Part two of the survey

1) Male or female?

- 100 4th grade students of Zrenjanin Grammar School took part in this survey. Out of the total number 50% were male and 50% were female.
- It was planned for the number of males and females surveyed to be the same in order to get the most valid results.

2) Do you want to choose information technology as a career path?

- The students were given a choice between YES and NO.
- The results showed that 36% of the male students wouldn't choose a career path in this area, while 64% would. On the female side 72% answered that they wouldn't want this as there career, while only 28% would.
- These results tell us that the number of interested female students is much lower than the number of interested male students. (Figure 10)

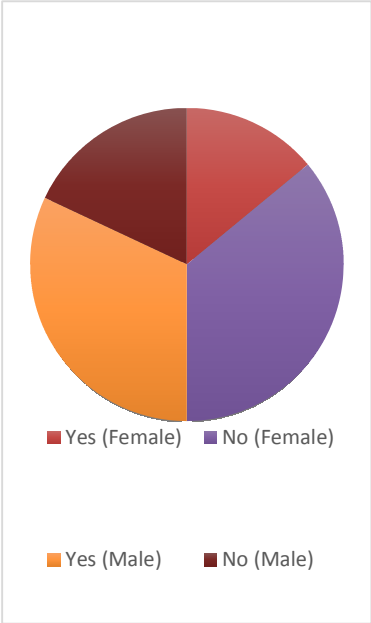

Figure 10. Graph of the second question results.

The main problem today is the role of women in science, about which debates and promotions were organized in Zrenjanin Grammar School. During one of the debates the students mostly said the same name when asked about the women in science, Marie Curie. They deemed that they didn't know any more because they aren't present in math, physics, chemistry, TIE and other textbooks. By looking at the textbooks, female students don't see information technology or sciences as a viable career path. By looking at the technical faculties and the "Natural Sciences and Mathematics" course in Zrenjanin Grammar School we can conclude that a relatively small number of women are interested for information technology.

V. CONCLUSION

The research conducted for this paper shows the stance of Zrenjanin Grammar School students when it comes to introducing information technology in the schooling system and their general interest for information technology.

Some further research that could be done about this topic could include:

- Questioning the negative stance of students towards introducing the "Information Technology" course.
- Conduct a nation-wide survey for more accurate results.
- Suggest methods of educating more women about information technology.

There are plenty of possibilities that would ease the introduction and development of information technology in the education system which would make it easier for students to get better education. Another thing that would help with this is an introduction of modern educational material which would be available to students at all times to get the latest news about information technology over the interenet.

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Cloud Computing Models for E-learning

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Abstract - Information technology creates dynamic environments in business, education and entertainment. The rise of information technology changed the way people communicate. Cloud computing technologies can create flexible and productive environments for companies, groups or individuals. Furthermore, cloud computing enables interactive model creating for e-learning. Additionally, cloud technologies ensure a safe way for data transfer. The e-learning concept includes a service through the Internet where distance learning is an additional asset for further development in online education. Cloud computing offers flexible working models for e-learning. This development can be measured through the increase of productivity and security. In this paper the use of cloud computing in e-learning will be presented.

I. INTRODUCTION

The information technology industry rapidly changes the way we learn and acquire information. New distribution channels emerge in a dynamic way. Information is shared in such a manner that everyone with an Internet connection can easily access the majority of the distributed data. Cloud computing technology is a new, innovative technology which can be applied for project management, company management, human resource management, education and other services [1].

Cloud computing has gained popularity and wide use among small and medium enterprises as well as big corporations and individuals. In addition, cloud computing services can be adjusted and personalized. Furthermore, many universities implemented cloud services into their classrooms, through which they can use for distance learning and other types of interactive studies [1]. There are many uses of cloud services. Researchers can develop flexible and dynamic platforms for data sharing and research analysis. In addition the costs of safe information and data sharing are drastically reduced [2].

Furthermore, productive learning platforms can be created. Nonetheless, cloud computing technologies can offer models for e-learning. In this paper the use of cloud computing models in e-learning will be addressed. Hence, the concept of cloud computing and e-learning will be overviewed. The paper has three main sections. The first section addresses the cloud computing architecture. Next, e-learning concepts will be analyzed. Third, the use of cloud computing models for e-learning will be defined and studied. Finally, a conclusion is given based on the research. The references used in this paper are new and topical articles which address the importance and main concept of e-learning and cloud computing technologies.

II. CLOUD COMPUTING TECHNOLOGY AND ARCHITECTURE

Cloud computing technology can provide a platform for data and resource access and sharing. This can be done through Internet connection regardless of location and time. Access to this platform can be configured and changed to fulfill the needs of the work or education environment. All data is processed on the "cloud" and users can access the files through devices which are connected via the Internet [3]. The requests of users are defined as an input, and the processed files which are sent to the users are defined as output. Furthermore, cloud platforms utilize complex calculations and high-capacity data processing. Thus, users can work more efficiently and overall productivity rises [2].

Cloud technologies are very flexible. A once set infrastructure can easily be expanded without burdening the resources. New accounts, user profiles, storage, services can be added without a big hustle. Furthermore, expanding costs are significantly lower than traditional types of company infrastructure development. Therefore, it can be assumed that reengineering processes with cloud platform support are far less harmful to business performance. In addition, cloud models for e-learning can be expanded and modified without the need to stop data sharing and data processing [4]. Cloud environments implement various forms of computing power and resources, thus it can be upgraded if new and resource - demanding applications are implemented. This way, productive work can be achieved [3].

Users can access files, sheets, messages and applications through devices as smartphones, tablets, personal computers, notebooks and other devices that support Internet connections. In addition, the lack of computing power of such devices is compensated. The cloud network allows any device to access pre-defined data and files. Access is granted through administrative rules. These rules define whether the user can download, edit or use a specific file [4]. To ensure security, cloud computing platforms implement personal identification, authorization and confidentiality applications and high-end security software [1].

The main architecture of cloud computing utilizes sets of virtual and physical devices, applications and networks. Cloud computing services are usually categorized in three groups [2]:

- Infrastructure as a Service (IaaS);
- Platform as a Service (PaaS);
- Software as a Service (SaaS).

Information as a Service provides consumers processing resources, networking and applications on-demand under a virtual machine. Platform as a Service is usually created upon IaaS and it gives users access to applications and services on the cloud infrastructure which is created using programming and runtime environments. The third group SaaS is consisted of applications that are provided through the cloud network instead of being executed on the users' device. All the resources on this type of platform are accessed with a web client [2]. There are different deployment models and their use is dependent on their purpose. The models for education are different next to models for administrative work tasks in big company branches [2].

The hierarchical view of cloud computing types is shown on Figure 1.

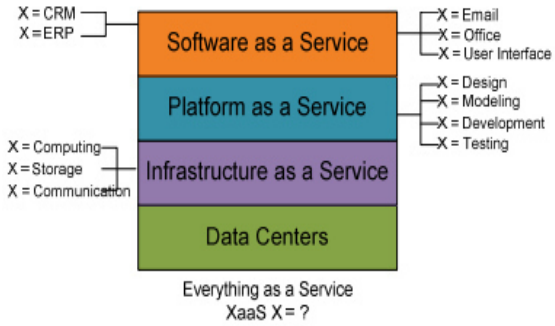

Figure 1. A hierarchical view of the cloud computing architecture

As defined before, Software as a Service is at the top, Platform as a Service is in the middle and Infrastructure as a Service is the third type of architecture. Data centers are the base of architectures and provide necessary resources in form of data and computing power [5].

Traditional hosting architectures are constructed in way where information is shared through the Internet to an IT infrastructure. Furthermore, data from the IT infrastructure is sent to other services which serve the end users. The three mentioned parts of the hosting process, the IT infrastructure, services and end users are collectively defined as a customer environment [3]. Modern cloud hosting services are different. Information is processed and sent to the end users directly through the Internet. The IT infrastructure, services and applications are executed on servers, and through the internet the end users can access the needed data, files or applications [4]. IT infrastructures are based on hardware and software. Security is provided with firewalls, user authentication and administrative passwords and access management applications. Services include application execution, storage, memory and computing power resources. All the information sent and shared within a cloud environment is safe from outside, unauthorized access [5].

The advantages of cloud computing are cost savings, reliability, manageability and strategic edge. Cost savings are manifested through reduced operational costs, no need for servers and massive hardware and other server infrastructure [4]. Payment for services is based on usage and resource allocation for application execution. Cloud computing platforms are more reliable than in-house servers. In addition, providers offer 99.99% availability and they guarantee that server shutdown is backed up [6]. Cloud platforms are easily manageable. Flexibility and dynamic changes are available. Strategic edge through cloud computing platforms is achieved with upfront costs and minimal provisioning time. This lets companies to develop fast-paced business strategies in almost real-time [6].

The main disadvantages of cloud computing are technical downtime, security, vendor lock-in and limited control [5]. Technical issues can happen due to overwhelming usage of server resources. Security risks are presents due to standardized industrial settings where experienced, malicious hackers can cause harm to sensitive data. Due to the "young" technology that is cloud computing, organizations sometimes have difficulties to change vendors or providers [7]. Furthermore, the whole cloud infrastructure is

monitored and managed by the service provider. This means, that access to certain data, authorization control and other administrative settings are "locked" to a certain point, where the company needs to address the provider first, and doesn't have the freedom to change and manage crucial services in the cloud computing environment [7].

III. THE CONCEPT OF E-LEARNING

E-learning can be defined as learning via an electronic media, most often the Internet. E-learning has more value compared to traditional learning and training options [8]. Furthermore, traditional learning and training through sessions and lectures are not as efficient as the new e-learning model [9].

E-learning can be asynchronous or synchronous. At the asynchronous type users don't need to follow a strict timetable. Synchronous e-learning includes web conferences, live streaming of chat rooms and meetings. The users have an option to participate or later review and learn after the lesson is already finished. This gives a tremendous amount of flexibility [8]. In addition, e-learning can easily be globalized. It can be placed online and everyone can access it, with the adequate permission. This way, users can cut down travel costs and hotel booking costs. Conference participants can enjoy and even give a presentation or go through training from the comfort of their own office or home [9]. Nonetheless, e-learning services, or to be more precise, online courses can be accessed on mobile devices such as smartphones, tablets or PDA devices. Also, it is possible to create, publish online courses and e-learning materials in a matter of hours. This is indeed important for companies who have fast-paced work dynamics and are often prone to work task changes. This way, e-learning courses can be accessed by people who need them in a short matter of time [8]. Cost reduction is one more of the benefits of e-learning. Organizations that use e-learning services and concepts, manage to save money and time by avoiding the traditional instructor learning and training sessions [9].

In the modern digital world, people, companies, groups and individuals are all present on social media sites, and other services and platforms through the Internet. Smartphones and other portable devices became a necessity for the majority of people. In addition, companies tend to follow new business trends in order to survive or be competitive on the market. Human resource training is crucial for effective knowledge management. E-learning concepts are becoming the primary way of training the companies' staff. Furthermore, e-learning services can give a novel way of knowledge sharing. Online courses are dominating over traditional learning sessions [10].

E-learning management processes include blended learning which combines online lessons with traditional classroom teachings. Further, e-learning management includes traditional learning and distance learning concepts. The mentioned concepts and their relationship to each other are shown on Figure 2.

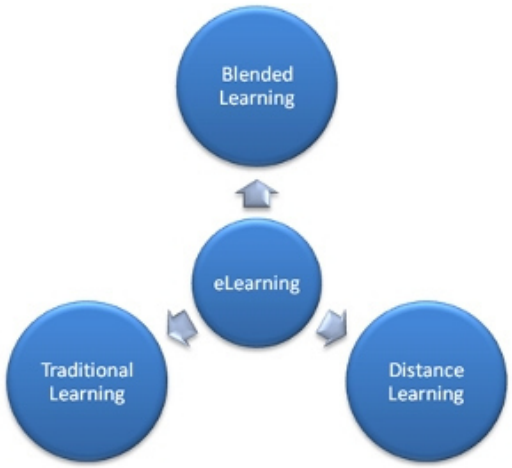

Figure 2. E-learning management and its relationship to other learning concepts

The advantages of e-learning are lower cost, improved learning, advantages for learners, advantages for instructors and advantages for organizations [8]. The cost of e-learning is 50% less compared to traditional methods. E-learning uses modern technologies to access its students and provides a more in-depth learning experience. Learners can get the best instructions and the training is realized at the right time at the right place. Teachers can teach from different locations and instructors travel less, lowering their expenses and simultaneously lowering the cost of the classes [8].

The disadvantages of e-learning are that more instructor effort is required, more effort from the learners is required, conversion efforts take longer than expected, distance learning can be impersonal and there are cases where participants or learners have fear from the technology [8]. Online courses take around 30% more effort from the learners to achieve the same amount of knowledge. E-learning is often used in the form of distance learning and that type of communication can be impersonal. Furthermore, people can experience

technical difficulties that discourage them to use e-learning services [8].

Summarizing the facts and concepts of e-learning, the following propositions are defined:

Proposition 1: E-learning drastically reduces costs compared to traditional teaching methods, however it takes more effort from the learner and teacher to acquire and pass knowledge.

Proposition 2: E-learning concepts are easily manageable and offer a wide variety of possibilities. Online courses dominate the market, but technical difficulties and necessary equipment for e-learning can turn down learners.

IV. THE INTEGRATION OF CLOUD COMPUTING INTO E-LEARNING SERVICES

Cloud computing services can be integrated with e-learning concepts. The framework model for e-learning through cloud computing technology is given on Figure 3.

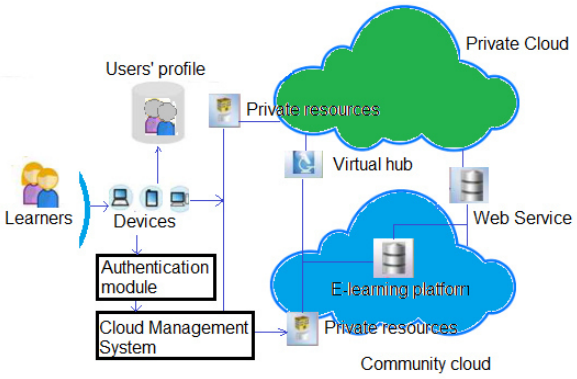

Figure 3. E-learning management and its relationship to other learning concepts

Figure 3. shows the e-learning framework based on cloud computing technology [11]. Learners use their smartphones, tablets, notebooks or desktop computers to access their profile. This information gives the users adequate authorization and grant at the authentication module level. Further, the cloud management system connects the users to private resources in the private cloud or community cloud. Web services and virtual hubs are used as a form of sharing and sending crucial information. The main component is the E-learning platform where courses can be accessed and group knowledge sharing is manageable. Cloud computing gives a secure platform where e-learning services can be realized.

E-learning system architecture on the cloud platform is consisted of three main layers [11]:

- Infrastructure layer that is managed by cloud the cloud resources;
- Content layer which includes e-learning databases;
- Application layer that incorporates all the other layers of e-learning services.

The e-learning infrastructure is powered through the cloud environment resources. The content layer includes databases where all the information which is shared and used, is stored. Users access all the elements and services of e-learning through the application layer [11].

The advantages of cloud-based e-learning are virtualization, centralized data storage, benefits to students and teachers through reducing costs, general lower execution costs, faculty monitoring, enhanced performance, fast software update and improved compatibility [12]. However, beside the vast amount of advantages of cloud-based e-learning, there are disadvantages as well. The threats for cloud computing are availability issues, lock in applications, major safety issues on the provider's servers, browser security issues, disposal of data is unsafe and there is a growing demand for cloud-based services. Further, there are e-learning security threats, too. There are problems with user authentication, sub-item classification, operations protection and security regarding social activities of users [12].

The mentioned risks and threats can be eliminated with careful infrastructure planning. This can be achieved with thorough programming and strong authentication methods, thus disabling malicious attacks on the servers. Cloud management systems offer a series of options to control and enhance the access to community and private cloud platforms. It has to be taken into consideration that cloud-based e-learning platforms include a huge amount of data and services. Therefore, it is necessary to thoroughly check "weak links" where attacks and breaches can occur.

Based on the researched concepts and models the following proposition is defined:

Proposition 3: Cloud-based e-learning platforms are efficient and need significantly lower costs of implementation. However, it is necessary to take into consideration the security risks and vulnerable points.

V. CONCLUSION

Based on the researched topic, it can be concluded that cloud-based e-learning platforms offer a lot of options when it comes to flexibility and accessibility. In addition, cloud computing technologies can manage big e-learning groups with high percentage of reliability. Furthermore, cloud-based e-learning platforms support advanced security measures.

E-learning models based on cloud computing technologies make modern educational concepts available to people all over the world. It is the future of education. More and more universities and companies are implementing e-learning services into their business model. Further, new security software and hardware is developed. It is matter of time when e-learning platforms will become an integrated part of education systems. Universities can focus on creating closed community clouds where all the students can share and distribute information and crucial data for their studies. This is applicable in many government institutes as well. Flexibility, lower costs and convenience are the major factors why the e-learning concept is well received by organizations and individuals.

The issues and threats can be addressed with appropriate security measures. Strong anti-malware software and other anti-malicious attack software is a necessity in the modern digital world where people tend to conduct harmful actions online.

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Innovative model of dual education through student-organization networks

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Abstract - Dual education systems can help improve the unemployment rate in country. Furthermore, dual education strengthens the economy. Countries like Germany, Austria and Switzerland flourish thanks to an effective dual education model. In the modern world, the job market is dynamic. In addition when unemployment rates are high, there is a serious bottleneck when it comes to hiring new people. Companies are flooded with job applications and have a hard time to choose the right person for the job. A unique registry, innovative dual education model could help fixing this problem. In this paper the Student-Organization Network (SON) model will be presented.

I. INTRODUCTION

Dual education systems are the core of economic wealth in countries like Germany, Switzerland, Austria and South Korea. Dual education includes apprenticeships in a company and vocational education. In many countries the main trend is to establish collaboration between educational facilities and companies [1]. Vocational education is has to be promoted in way to attract more students compared to theoretical studies. It is an imperative to create stable conditions which companies and students can and will follow. In addition, it is important to distribute the values that trades offer to society. Furthermore, in countries in transition like Serbia, education can positively affect the demographic structure [2]. In order to create collaboration it is necessary for a country to have highly educated human resources in order to develop manufacturing companies and open new jobs and apprenticeship programs [3].

In this paper the main concept, benefits and disadvantages of dual education will be researched. The whole paper addresses two main concepts. First, the concept of dual education will be analyzed. Second, an innovative model of dual education will be presented. This model incorporates dual education concepts and student-organization networks.

The model is only a crude presentation of a complex "mechanism". In the paper the organizations, the infrastructure, the specific actions and model elements will be defined. However, details of the documents and statements in the documents won't be presented. This is due to the fact that this kind of procedural documentation for a project this big can't fit in a conference paper. The model addresses the possible solutions for a strong and effective network for students and organizations in order to achieve a high degree of apprenticeships and internships. Unfortunately, there is still little action taken in the area of dual education and companies are not keen to often offer internships for students.

Furthermore, the main concept of an innovative model is created in a non-experimental environment. It is strictly theoretical. Consequently, all the actors in the realization of this model are not defined or named. Moreover, the main focus will be on the elements of the complexity of dual education. These elements are based on theoretical observations of scientist and credible people in this field. Furthermore, the German, Austrian and Swiss dual education models will be analyzed.

The paper will address the key concepts of dual education and dual education models in order to achieve a synergy in this research.

II. DUAL EDUCATION

Dual education has managed to create a stable economy and plummeted unemployment in countries who effectively implement the concept into their laws. Germany has managed to create almost a unique environment for students with more than 350 apprenticeship courses [2]. Furthermore, Kazakhstan's president decided to relinquish poverty and boost economic growth by creating a dual training program. This program included preparatory stages for regulatory documents, development of educational programs, signing contracts with companies, identifying training courses for professions, preparation of class schedules, monitoring and control of learning inputs and outputs, pilot test training,

systematization and generalization of results, data processing and introduction of results into practice [1]. There are some expected results from dual education implementation. These are competence forming in order to allow students to choose their profession consciously, expanding of the labor market and growth of demand for graduate students, improved quality of student training and acquired skills, developing interaction between educational organizations and companies by involving them into the start of the implementation process, increasing vocational training, reducing unemployment among young people and improving competitiveness of faculties [3]. A simple model of dual education is shown on Figure 1.

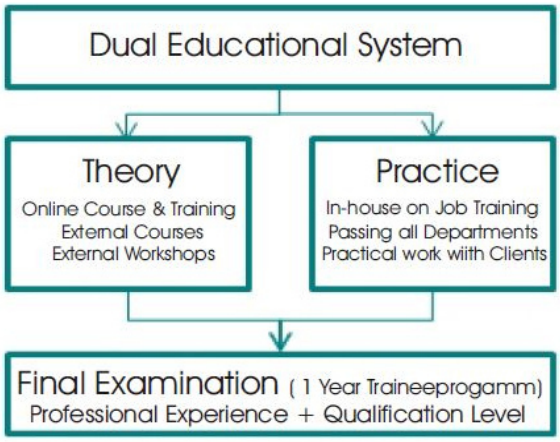

Figure1. Dual education, a graphic view of a simple model

Figure 1. shows that a dual education system is consisted of theory and practice. Theory includes online courses and training, external courses, external workshops and formal education courses [4]. Furthermore, the practice part includes in-house on job training, passing all departments and practical wok with clients. After the courses are completed a final examination is conducted. This examination includes a one year trainee program, thus the student acquires professional experience and an adequate qualification level. Theoretical courses are used as a base for further practical knowledge. The whole system is designed in such a way where practical experiences are complementary to theory. Practice includes apprenticeships and internships. In Germany, these apprenticeships are most usually paid [2]. Dual education models are gaining popularity in the majority of developed countries and even more so in countries in transition. However, problems emerge when it comes establishing a strong infrastructure for the dual training courses. Still, it is important to note that the apprenticeship program is very time consuming and needs a lot of financial resources. In addition, adequate human resources are required for an effective dual education model development [5].

Internships and apprenticeships are important part of dual education. They provide a framework and connection between coursework and workplace. Students appreciate quality internships and apprenticeships. Organizations can also benefit from interns. Students often bring ideas from a new perspective and new knowledge. The advantages of apprenticeships and internships are [6]:

- students acquire work habits and broaden their views;
- apprenticeships promote healthy work ethics and offer experience for students;
- new collaborations between companies and educational organizations strengthen the economy;
- unemployment rates are lowered, especially among young people;
- students enrich their CVs with experience;
- employment after graduation rises.

Through apprenticeships students can learn new skills, earn money and gain experience. Collaborations between companies and educational organizations ensure steady growth on the job market, where the number of skilled workers rises, and industries won't suffer from unskilled workforce. Likewise, students are more competitive on the job market and can find work more easily. Nonetheless, students enrich their CVs with valuable experiences, thus their starting salary can be higher.

Dual education models can offer great benefits but there are negative sides as well. The disadvantages of dual education can be [6]:

- failed integration can cause heavy financial losses;
- superficial collaborations between organizations and educational organizations create false hope and ineffective apprenticeships;
- students can show little interest in working for little or no money as an intern;
- companies tend to exploit interns and apprentices.

However, an effectively implemented dual education model can change the whole economy of one country. In Serbia, dual education is not integrated into the education system in the right way. Therefore, students who study a trade indeed have practical experience, but often it is not effectively executed. This is due the lack of strong industries and serious employers [2].

It is necessary to develop strong and effective networks between students and organizations while the educational organizations (universities, high schools) only play a role as a "middle man". In addition it is necessary to develop cluster networks where students can share experiences and give feedback to the organization where they fill an intern or apprentice position [7]. Websites like LinkedIn are a great example how networking and meeting new people have a positive effect on job searching and creating lead. Through social media job offers can occur more often than not [8]. Furthermore, LinkedIn can present the major skill sets a person has, thus creating a clear picture for the potential employer. However, this is not limited only to job positions but also for internships and apprenticeships. The advantages of social media networking and personal career profile creating are [8]:

- big number of options for profile personalization;
- internship and apprenticeship opportunities;
- details of companies and organizations;
- categorized job openings;
- skill categories and skill endorsements;
- relatively easy contact with employers.

Learning on the job is important for interns to create a sense of belonging [9]. Furthermore, students need to regularly update their career profile. Research has shown that students who are active on their social network and focused on their skills and career goals are more likely to land a job that is best suited for them [10].

Further in this paper a new model of dual education will be presented. The model surely has flaws, and the basic, crude concept that will be given here is only a solid starting point for further research. This kind of model needs strong project management and a productive and effective working environment. In addition, strategic planning is required. Some of the details are going to be presented in the next chapter.

III. STUDENT-ORGANIZATION NETWORK (SON) MODEL OF DUAL EDUCATION

Student-organization networks are the key to successful dual education implementation. Germany has strict laws where students attend apprenticeships in various companies. The best example is the collaboration of Siemens and vocational education organizations where 2.140 new trainees were accepted in 2013 alone [11]. Figure 2. shows the percentage of students at the Siemens Technical Academy and Technical apprentices and students.

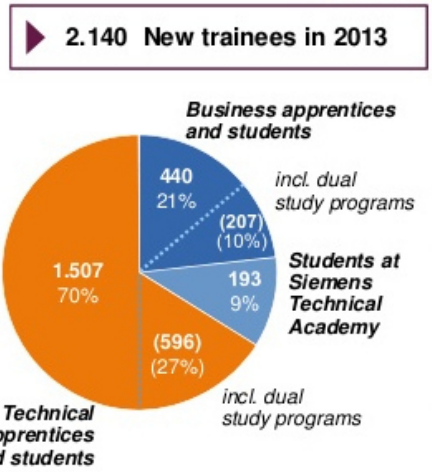

Figure 2. Number of trainees in the Siemens Technical Academy

Next the student-organization network model will be presented. The model's core is a network based on social media platforms such as LinkedIn, research and data sharing, a cloud community with dynamic storage and a platform for connections management and contract signing. These elements are the pillars of the student-organization network infrastructure. LinkedIn offers a good start. Students can create their own profiles and write down their skills and wishes for the next project, internship or job. The platform for connections includes security software and authentication options for both students and companies. Every student is given a unique registry number. This number is permanent and will be used and addressed by companies. On Figure 3. the network module of the model is shown.

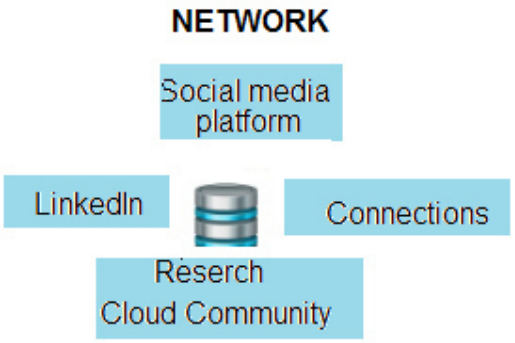

Figure 3. Network module of the dual education model

Furthermore, companies can also connect and should connect to the network. The "connections" element is the platform where pre-contracts can be signed. Companies offer experience, technical knowledge, professional skills, social skills, methodology, monitoring and delegating. These must be regularly and tidily documented in both digital and printed form. It is recommended that students get an index where all the activities from the internship and apprenticeship are recorded. On Figure 4. the company module is shown.

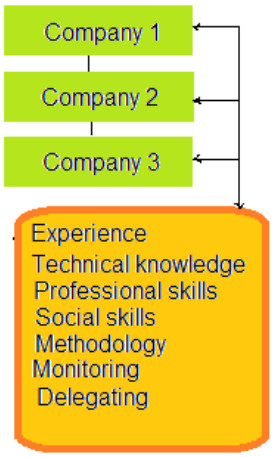

Figure 4. Company module of the dual education model

Next, the following module contains the regulatory bodies. This module is indeed important, because without the support of these actors, the network and collaboration wouldn't work. Undoubtedly, there would be exploitations of interns. This module includes the government, vocational schools, quality check, legal framework, financing and validation of success. Similarly, a support module for the regulation body includes chambers, registries, the main registry and organizations. The regulation module is shown on Figure 5.

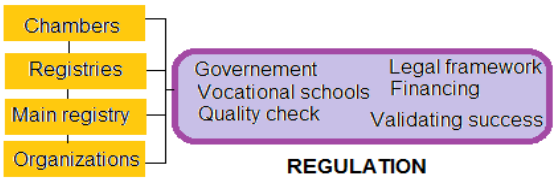

Figure 5. Regulation module of the dual education model

The mentioned modules are all connected. Students are connected via the network with the companies. There is an option to choose internship or apprenticeship programs. Companies offer their job or intern positions. The regulatory body acts like a "middle man", and regulates all the documentation and defines the work tasks beforehand. Companies collaborate with the regulation body and the information provided to the students must be the same as the information provided to the regulatory module. Every student in the network is registered and has a unique registry number. This number provides easy control, monitoring and access to the student progress as an intern. This way, the student is protected from non-ethical behavior from the company where he works as an intern.

On Figure 5. the student-organization network (SON) is shown. It can be seen that all the modules are connected, and that the "NETWROK" is the main component which ensures strong and dynamic connectivity. The regulatory body is not connected to the network. It works on its own servers for security purposes. Once a student finds a company through the network, he is processed to the other modules in order to start the internship or apprenticeship as soon as possible.

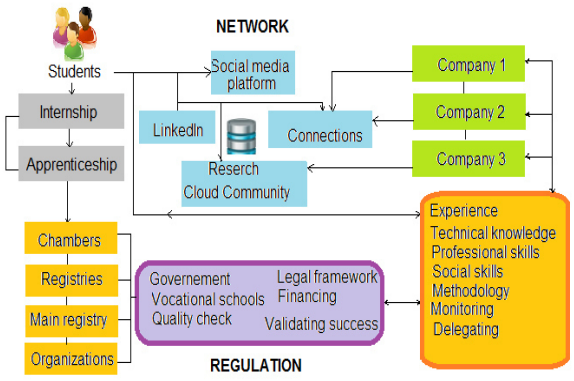

Figure 5. Student-organization network model of dual education

IV. CONCLUSION

The proposed model is not presented in a detailed manner. This is due to the complexity of the model and all its elements. It can be concluded that dual education is important for reducing unemployment and increasing after graduation employment. Countries like Germany, Austria and Switzerland have managed to develop, implement and stabilize a strong, effective and flexible dual education model. The student-organization network (SON) model is focused on IT technology. Furthermore, cloud computing can and should be integrated into the network module. That way, students can have a flexible, transparent, secure environment where they can meet new potential employers, find information about companies and share information between each other. The regulatory module is crucial for ethical and legal implementation and execution of the SON dual education model.

Every module is complex. The elements in the module require serious and hard work. Furthermore, stable financing is needed. The whole implementation process is somewhat similar to a reengineering process. Therefore, it is necessary to hire the right people for the job of implementing and monitoring the dual educational models. Further research and project management is needed. A detailed plan for every element and sub-element is recommended.

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Information exchange models for Internet of Things Technology

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Abstract: Internet of things (IoT) is networking technology of physical devices, also called smart devices, usually embedded with sensors, microprocessors, actuators and connection interface, which enables secure connection, collection and data exchange between such units. IoT enables a wide range of applications in areas such as home automation, building automation, factory monitoring, smart cities, security monitoring, energy management and transportation. The communication between these smart devices enabled with a wide range of communication protocols. One example of such standard is the Internet Protocol, globally established by Internet Engineering Task Force (IETF) and IPSO alliance, where their latest generation IPv6 is considered as a critical component for successful development and application of the IoT. The choice of communication protocol is a critical stage when implementing IoT within new projects. For this decision usually considered factors such as the protocol type, the communication approach and the underlying infrastructure of the system under development. In instances where such decision-making process is not present, the project has a higher risk of a situation leading to overall modification of the code, infrastructure and the models for security of sensitive decisions. In the present work are discussed models for data transfer in networks of IoT.

I. INTRODUCTION

Internet of Things (IoT) becomes the next revolutionary leap of development, compared to the invention of the steam engine and electricity in industrialization. Today, digital transformation changes many different sectors of the economy and our environment. This process finds the various economic areas of varying degrees of preparedness for change. The most ready for change are applied electronics, transport, logistics, the financial sector and even agriculture.

In an industry already, work hundreds of millions of devices ready for communication. These include smart maintenance, repair and logistics systems, intelligent pumps, compressors and valves. A large number of devices are already working in electrical power grid and utilities sectors: multiple counters, distribution network components, consumer equipment, power supply infrastructure, and renewable energy and distributed power infrastructure. In the field of health care, diagnostic tools, mobile laboratories, various implants, telemedicine devices connected to IoT.

It expected that in coming years the number of machines involved in the network is going to increase by 25% per year. By 2021 number of connected devices on planet, it will be around 28 billion of these; only 13 billion will be the usual consumer items like smartphones, tablets, laptops and PCs, while 15 billion will personalized and industrial equipment such as different types of sensors, sales terminals, cars, displays, indicators, etc. IoT will continue to be deployed everywhere and more and more simple and complex devices need to connect to the network. The mass character of the inclusion of different devices, different scenarios for application lead to a wide range of requirements for network technologies for IoT as: speed of data transmission, delay latency, reliability to determine by the characteristics of the transmission and the specific application and differ from traditional mobile Networks.

Data sharing schemes are important for the transmission of data. Before starting work on a new IoT-based project, it is necessary to assess the possible models for information; exchange is best suited to the particular project. In order to make this decision, the protocol, the communication methods and the supporting infrastructure of the developed system must specify. If these factors not taken into account, the designer is likely to be in a situation that will lead to a complete revision of the code, architecture, and decision security model.

The purpose of this article is to present some specific data exchange models for IoT-based networks. These models enable designers in the initial design stage to determine what the appropriate model is the right one. This choice will allow acceleration of the design process.

II. MODEL OF THE IOT NETWORK

There are different models for realization of the Internet of Things, depending on the objectives and tasks being solved, for example, for monitoring, management, monitoring of private, industrial sites for health care, collecting and analyzing different types of data, etc. The architecture of the Internet of Things has the following functional levels [1,5]: sensor level, network level, management levels and application. Sensors working on the sensor level are usually tiny, with a small memory measured physical parameters in real time in terms of low energy supply. Measurement results are processed in a sensory node and transmitted to a server. The amount of information in a sensor node is not large. The IoT network is built on the principle of multi-node processing, which in principle differs from the accepted architecture of classic client-server messaging networks. This difference leads to a new architecture: many sources and many recipients, as the sensor data traffic can be as large or small.

A. Topology Analysis of the IoT Network

The topology of the IoT network corresponding to architecture presented on Fig. 1 [6].

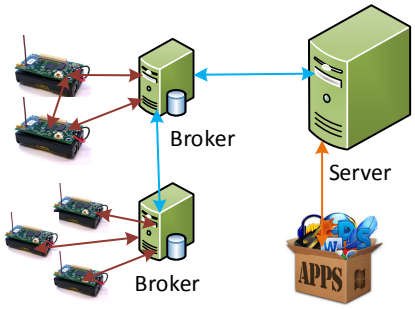

Fig.1. Model of IoT topology

Consider the case where the sensor node merges information from several sensors and transmits the data on a schedule or upon request at a certain interval to the Broker. The broker is a server in a complex system accepts data from sensors and transmits to the consumers perform complex analytical and process the received data. The broker can prioritize messages and their sequence in transmission. If the channel is insufficient, or if the recipient is unavailable while the messages sent, the queue stores the messages until recipient comes available. Therefore, communication between the elements such a system requires special protocols. These are protocols for communicating between sensors, brokers or servers.

Communication sensor-sensor

Figure 2 shows a section where the information between the sensor nodes for temporary storage or redirection is distributed. A DDS (Data Distribution Service) protocol is applied.

Fig.2. Communication between sensors

The DDS protocol distributes the data between devices by realizing a right bus connection between sensors based on a relational model for data transmission. The DDS protocol implements a multiple addressable system using UDP. The protocol transmits the bus messages on the request response model. The operations performed by the protocol are thirteen classes: (Entity Class, WaitSet Class, Condition Class, Publisher Class, DataWriter Class, Subscriber Class, Data Reader Class, Read Condition Class, Query Condition Class, etc.). The DDS protocol performs two operations - reading and writing using the appropriate classes. The operation recording is primitive. The Read operation performed on all available devices. The data obtained can realize in three ways:

Polling – An application that periodically asks DDS for new data or status change information. The interval of the inquiry depends on the application and the data.

WaitSets - Waiting List, which registers a DDS waiting list and waits until a transmission event generated.

Listeners - an application that registers in DDS special classes of listeners who will be informed when these events occur.

Sensor-broker

In this segment, accomplish tasks such as registration of the sensor unit, the configuration and setup of nodes transmitting and redistribution of information, etc. Two protocols can used in this segment of the IoT network (fig.3).

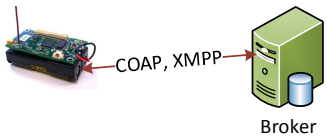

Fig.3. Communication sensor-broker

XMPP (Extensible Messaging and Presence Protocol) is data exchange protocol and presence information. In IoT networks, XMPP provides a simple way to address devices. User identification using memorable identifiers like email addresses

(for example, username@jabber.com). The TCP protocol used to transport the data. XMPP uses various communication models such as Request-response and others. The addressing of XMPP is convenient when data transmitted between remote independent points. Protocol for IoT networks with limited resources, with low energy consumption for M2M applications, more suitable Constrained Application Protocol (COAP). COAP uses the UDP transport protocol. Message reports are not many, some answer questions are: GET, PUT, HEAD, POST, and DELETE, CONNECT.

Broker-server

In this segment of the network IoT broker collects and aggregates, organizes the sequence of transmission of messages, distribution and storage of information "on demand" - Figure 4.

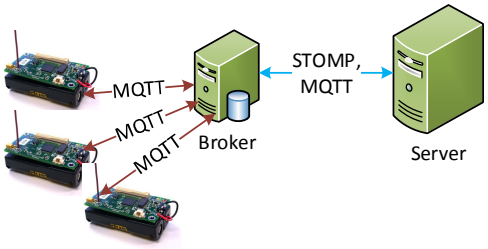

Fig.4. Broker-server communication

For networks with a large number of devices, it is advisable to select a protocol that reduces the channel load over the queue - Message Queue Telemetry Transport (MQTT). This protocol is useful for telemetry and remote monitoring. Simplified scheme for exchange of messages is shown in Figure 5.

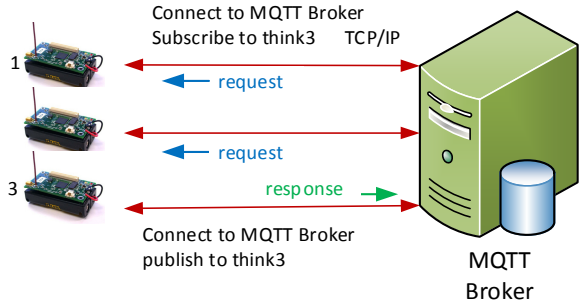

Fig.5. Simplified scheme for exchange of messages

The protocol uses 14 messages suggestive of a request-response: CONNECT, CONNACK, PUBLISH, PUB, PUBREC, PUBREL, PUBCOMP, SUBSCRIBE, SUBSCRIPTION, UNSUBSCRIBE, UNSUBACK, PIN GREQ, PINGRESP, DISCONNECT.

For IoT networks using equipment on different platforms, the STOMP Simple (or Streaming) Text Oriented Message Protocol [7] can be used. The protocol organizes communication with the broker using the "answer question" method via SEND, SUBSCRIBE, UNSUBSCRIBE, BEGIN, COMMIT, ABORT, ACK, NACK, DISCONNECT.

Server – application

This network segment provides interaction of the server with the user's application. (Figure 6). Obtained information from the server, configure parameters such as frequency of the received information, activation and deactivation of the sensors, etc.

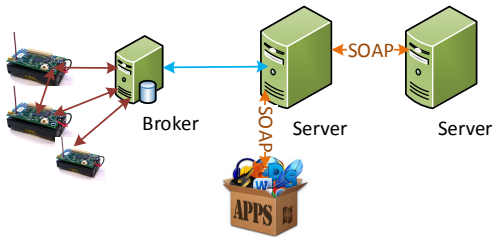

Fig.6. Communication server-application

The most common is the Simple Object Access Protocol (SOAP) protocol, which has Remote Procedure Call (RPC) and is responsible for remote call calling. SOAP supports two access mechanisms - SOAP RPC and SOAP Message [8]. SOAP RPC protocol is simple "Request-response", which is based on the object Call for synchronous remote procedure call with XML. SOAP Message - is a protocol for sending and processing SOAP messages for asynchronous communication and an immediate or urgent answer to a question. The SOAP Message based on the Message object. Thanks to several messages like Get; SOAPAction, SOAPAction-Response, the protocol can be used with application-level protocols like SMTP, FTP, HTTP and HTTPS.

III. INFORMATION EXCHANGE MODELS FOR INTERNET OF THINGS TECHNOLOGY

Pretend to be a new IoT project, stand out in terms of volume, which models share the information you need to know about it. Important decision for the exchange of information to taken at an early stage, especially during the protocols, ways of communication and auxiliary infrastructure of the designed system. The basis of this consideration lies a simple reason: if no such decision at an early stage of design, the designer risks seriously recasting architecture, security model and other environmental communications solutions at a later stage.

A. Request-response model

The "request-response" model (fig.1), this is probably the most widely known model of information exchange. Its implementation provides for the presence of a client, or a calling party, which performs queries on a service located on the server providing the services. The server also called the responder.

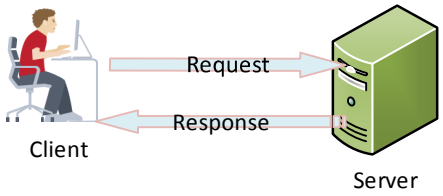

Fig.7. Request-response model

The model uses the HTTP protocol. It is also the basis of service-oriented architectures, web services and REST-solutions. This is a practical model, if the architecture of the project provides the presence of client and server parts or master and slave entities. In addition to HTTP, the request-response model supports protocols such as Constrained Application Protocol (CoAP), Extensible Messaging, and Presence Protocol (XMPP). The main disadvantage of this model is the inequality of the participants of the data exchange, which is quite evident in the Internet topology. Bidirectional data exchange between the two nodes may be complicated, especially if there are network screens on their way. When planning to use the "request-response" model in the project, you need to decide which parts of the system will be clients and other will be servers. If, for example, some sensor is a client, and the IoT-gateway is a server, the sensor will decide when to send its own readings to the server. The servers, if he needs information from the sensor, independently ask for them. However, there is one problem: if the sensor not sufficiently protected, anyone can connect to it. If the solution involves a reliable security system, then, a consequence, the way of interaction between the client and the server will become more complex. Perhaps in the project it will be necessary to add additional services, the sensors will have to be equipped with hardware that is more powerful. In addition, all this will be more difficult to manage.

B. Model «event subscription »

Models event subscription enable the client to subscribe to its own set service type. The server communicates with client to each other, as long they have interested to communicate. As a result, the need for a permanent query on the server it is dropped.

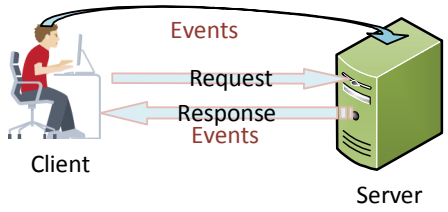

Fig.8. Model «event subscription »

Event subscription depends on the interest of the client. The advantages of the event subscription model consist in the fact that the exchange of data between client and server requires two times less messages. In addition, the data transmitted to the client when an event occurs, not a query, which minimizes the time between the occurrence of a situation that is of interest to the client and the moment the client understands about this situation. Protocols that support this model include CoAP, XMPP and General Event Notification Architecture, which is part of the Universal Plug and Play architecture, based on HTTP.

C. The model "asynchronous messaging"

Asynchronous messaging provides the ability to send messages between peer systems, located on the same hierarchical level (fig.3).

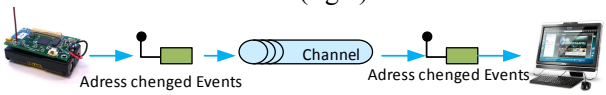

Fig.9. Model "asynchronous messaging"

This model involves bidirectional messaging. Asynchronous messaging involves a client that does not wait for a message from the server. An event used to trigger a message from a server. So if we have even and the client is not available, the messaging will complete successfully. Asynchronous Messaging means that, it is a one-way communication and the flow of communication is one way only. If the protocol used supports asynchronous messaging, you can build any other data transmission models based on it. Additional protocols that support active models may be called XMPP, Advanced Message Queuing Protocol (AMQP), and, at the level of IP - User Datagram Protocol (UDP). However, in the case of using UDP to implement this model, there may be problems with firewalls.

D. Model "multicasting"

The multicasting model sends the same information to several recipients at the same time. Within this model, the sender sends one message through the intermediate system (Broker, router), after which the message sent to several recipients, each of which was registered to receive similar messages.

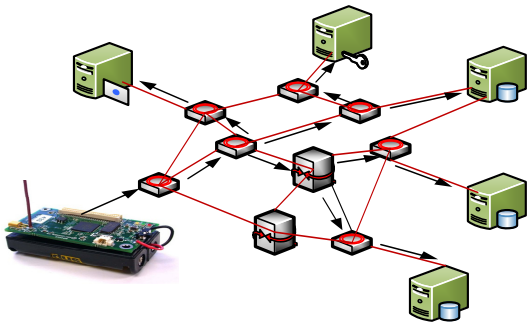

Fig.10. Model "multicasting"

Using this model can reduce the load on the network, since the sender does not need to send the same message to everyone who expects it. In fact, the sender does not even need to know who will receive the message. This model can be very useful in a variety of situations. For example, when synchronizing multiple devices or distributing the same data among several recipients. Multicast messaging supported by XMPP, AMQP, and UDP. With regard to increasing the efficiency of using network bandwidth when using multicast data transfer, resources can saved only if the recipients consume most of the data received. For cases where the recipient does not use a significant part of the data, there is another model.

E. The "Queue" model

Queue, namely - the FIFO queue - is a model of communication that allows one or more entities to send certain messages or tasks for processing in the queue, after which one or more recipients to receive these messages in the order in which they are be pleased in the queue in the specific order.

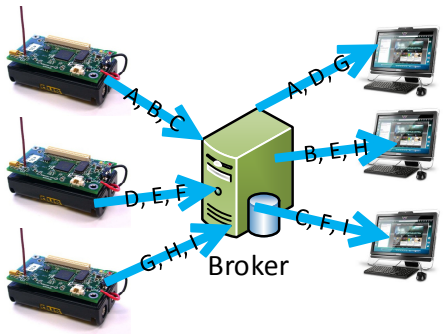

Fig.11. Model "Queue"

The queue is usually located on an intermediate node, or on a network to which all data exchange participants are connected. Queues are a great tool for balancing the load. The queue collects jobs from various sources and distributes them among existing handlers, possibly with different performance. Using a queue, can avoid a tight connection between the systems that transmit data, these data are receiving and processing. As a result, depending on the actual workload of the system, it is possible to increase or decrease the number of data receivers and transmitters. The AMQP protocol has built-in support for queues.

F. Model "federation"

The model is an important model in which a global network divided into logical parts. This allows scaling the solution globally and provides everything necessary for its natural growth. The basic idea here is allow increasing the size of the solution, not limited by the performance of the existing network infrastructure, using the approach of "Divide and conquer".

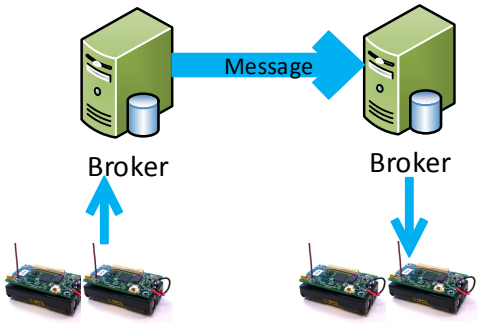

Fig.12. Model "federation"

When making a connection without brokers, for example, as with HTTP and CoAP, a federated structure exists at the domain level. Each domain points to its own set of IP addresses, and its own web server is associated with it. The system can add new web server in the new domain, not restricting access to existing systems. This approach is one of the main keys to the success of the World Wide Web. Using protocols that provide availability of brokers and supporting federations or brokers interconnected for routing messages. Each broker manages authentication in its own domain and knows how to connect to other domains to redirect messages to them. In addition, federated networks with brokers provide a convenient solution to the problem of global identification of data exchange participant. The most widely known protocol that uses brokers and federations is Simple Mail Transfer Protocol (SMTP) and XMPP.

G. Model „discovery"

Consider a hypothetical example. Suppose, we have a certain device manufactured at the factory, which planned to use in a system with multicast data transfer, we immediately encounter some difficulties connected with the integration of devices into the system. This is so, because the "things" are only aware of their own identification information (MAC-addresses), but they do not know anything about how they will be "visible" in

the network to which they are be connected, or about some main network device, with which they have to interact. After installation and configuration (the more automated the setting is, the better), the "things" learn about their network identification information, but not how to connect to the host device. The host device known network address, but not knows the network data to other devices. The model "discovery" allows creating a mechanism by which the network credentials of slave devices mapped to the network data of the master node.

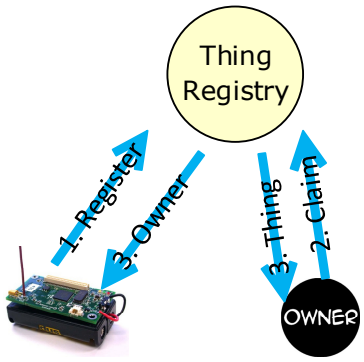

Fig.13. Model "discovery"

This done using general knowledge about the initial identification parameters of the slave devices. This model implemented using the "Thing Registry", available on the network to both the "things" and the main device. Clients register in the registry, and the main device accesses them through the registry, using only their factory identifiers. If the request is successful, the network identity of each of the communication participants sent to the other, and both thus know how to interact with each other. An XMPP extension supports this model.

H. Model "delegation of trust"

When using the "delegation of trust" model, the end devices redirect requests to a more securely trusted system in real time. After receiving the response, perform certain actions. In order for this model to implemented, it is necessary to use asynchronous bidirectional messaging. An XMPP extension supports delegation of trust.

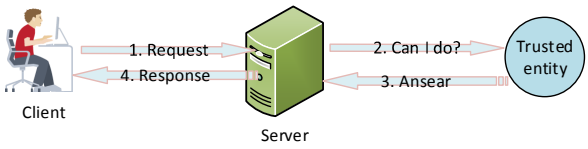

Fig.14. Model "delegation of trust"

IV. DISCISSION AND CONCLUSION

There are a variety of protocols, standards and approaches for making communication between network elements of Internet of Things. In each area, there are specific requirements that meet the requirements and needs of the solved tasks. Therefore in this work is an analysis of communication between different segments of the network Internet of Things, and appropriate communication protocols.

There presented eight models for exchanging data on the Internet of Things. These models enable network designers to determine the most appropriate model in the initial design phase. Choosing the right model for data exchange and communication on the network will allow for the acceleration of the design process.

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Using Photogrammetry and Laser Scanning for Monitoring of Architectural Heritage

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Abstract - Cultural heritage is exposed to ongoing changes and damage of materials, construction and finishing details. Natural disasters and climate changes have huge impact on cultural heritage sites and they frequently destroy cultural assets. Destructive power of nature can affect the built material and lead to the complete destruction of the building. Therefore, continuous monitoring of architectural heritage sites is becoming inevitable. This paper discusses importance of research, documentation and preservation of cultural heritage using modern technology in the field of photogrammetry and laser scanning. In Serbia, research and documentation of the rich architectural heritage is based on classical methods and skills. Examples of architectural heritage in Serbia on which was applied modern recording techniques and the proper processing of the obtained data for further use are rare. Contribution of this paper is creation of the idea and need to explore different approaches and experience, to set the objective for improvement in the field of research and protection of cultural heritage using photogrammetry and laser scanner in order to make proper survey and documentation in Serbia.

I. INTRODUCTION

The cultural heritage may be defined as the entire corpus of material signs - either artistic or symbolic - handed on by the past to each culture and, therefore, to the whole humankind. As a constituent part of the affirmation and enrichment of cultural identities, as a legacy belonging to all humankind, the cultural heritage gives each particular place its recognizable features and is the storehouse of human experience. The preservation and the presentation of the cultural heritage are therefore a corner-stone of any cultural policy [1]. Architectural heritage is only one part of the material heritage, but in which are intertwined artistic and use value which directly depends on the degree of preservation and vulnerability.

According to UNESCO´s World Heritage Committee, *Article 11 (4)* of the Convention, among others, includes 55 properties of natural and cultural assets, on the List of World Heritage in danger [2].

In the past few decades we have witnessed intense climate change. On the 10th scientific conference Measures to reduce the risk of the consequences of extreme rainfall held in Belgrade, in December 2015, attention was drawn to the alarming situation of architectural heritage, the strategy for the preservation and protection regarding the impact and consequences of climate change in general. Considering the marginal treatment of heritage from the initial phase, ie. hazard predictions, until the final restoration and presentation after disasters should propose a series of recommendations and actions, which should help in the shortest possible time and in the most efficient way to eliminate the consequences of natural disasters [3].

II. NATURAL HAZARDS AND ARCHITECTURAL HERITAGE

Natural hazards are natural process that poses a threat to human life or property. When hazardous event causes significant damage to life or property then it is called natural disaster. The potential impact of a natural disaster is related not only to event size but also to its effect on the public [4]. Cultural heritage represents the legacy of human beings on the planet. Therefore, increasing the awareness of the need for its preservation is inevitable [5]. There are many different impacts of natural hazards on cultural heritage. Landslides, snow avalanches, precipitation, floods can destroy cultural assets immensely fast. On the other hand, natural hazards can affect built material even before the natural disaster occurs. For instance, slow moving landslide activity is equally able to destroy cultural heritage site although it takes long period of time to get the full hazardous impact [6]. Accordingly, timely monitoring of the changes on buildings can prevent further destruction.

There are many types of damage on built material that can be further prevented if it is noticed on time. For example, different categories of landslides can lead to stress conditions on the object and the appearance of cracks and fissures in all constructive elements. Design and performance are the most important issues considering the efficiency of local structural measures [7]. Furthermore, knowledge of specific resistance of conventional construction materials to natural hazards is crucial in mitigation of consequences of disasters. It is known that reinforced concrete and steel have high resistance to avalanches, debris flow, rock fall and floods, while loose fill material such as soil has very low resistance to debris flow. On the other hand, walls built from concrete have very high resistance on all four most frequent natural hazards, contrary lime sand bricks and timber framings showed very low resistance and can be damaged easily. Finally, wooden doors, timber sets, sandstones and marbles presented very low resistance to floods, therefore they should be outflanked in construction [7].

However, little information is available on local structural protection measures so far, in particular with respect to different types, designs and materials used [7]. The framework of integral risk management requires a combination of active and passive measures to reduce the impact of natural hazard processes. Thereby, active measures are applied to mitigate the process and passive measures are based on the principle of a spatial separation of values at risk from endangered areas [7]. One of the best responses to risk is prevention, while monitoring of changes that can lead to destruction of cultural heritage sites is indispensable measure. The monitoring of temperature, water content, moisture changes and other aspects in response to different micro-environment of building stones is essential to understand the material behavior and the degradation mechanisms [8]. Development of new methods of monitoring changes of construction materials is both commercially and scientifically important [9].

Choosing the right constructive material is one of the most important tasks when it comes to mitigation of consequences of natural hazards. There are few classifications of damage which can be observed on built material, and they can be made based on several aspects. For instance, very important factor is the type of cultural heritage, according to the type of construction material and the type of structural assembly. Some of the consequences can be seen as cracks and fissures in all constructive elements, especially in the area of the ground. Furthermore, special amount of moisture and water from rainfall, as well as changes in swelling of materials, especially in terms of traditional building materials (such as wood, adobe, etc.) can lead to appearance of microbiological processes [10].

Finally, usage of photogrammetry and laser scanning for continuous monitoring of architectural heritage sites is inevitable. In that manner, many cultural heritage sites can be protected and consequences of natural disasters can be minimized.

III. USAGE OF PHOTOGRAMMETRY AND LASER SCANNING

In the face of the transcendent task to preserve our cultural heritage for future generations, 3D laser scanning opens a door to document, study, understand, and monitor any element or site of cultural world heritage. Very important part is measurement of different treasures so local planning authorities and specialists like archeologists and conservators can make better decisions based on reliable and useful information (Figure 1.). If this kind of information is measured and collected, it is possible to rebuild the pieces of heritage in case they get lost or damaged in the future [11].

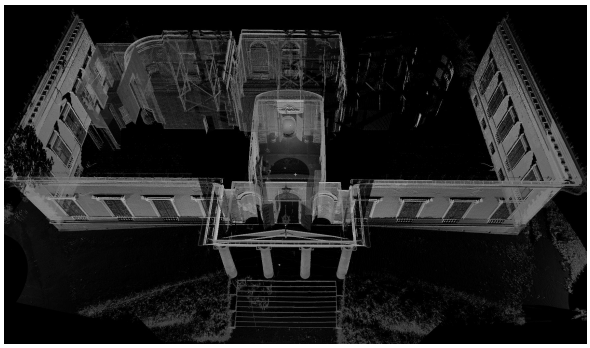

Figure 1. A drawing generated from laser scanning data and narrative imagery (courtesy of Michele Curuni)

Laser scanners operate on one of three ranging principles: triangulation, time of flight or phase comparison. **Triangulation** scanners calculate 3D coordinate measurements by triangulating the position of a spot or stripe of laser light. **Time of flight** is systems based on the measurement of the time of flight of a laser pulse and appropriate to

architectural conservation activities and they typically offer a point accuracy of between 3 mm and 6 mm. In comparison to triangulation systems, scanners using the time-of-flight method are more suited to general architectural recording tasks, owing to their longer ranges. This type of scanner can be expected to collect many tens of thousands of points every minute by deflecting this laser pulse across the surface of an object, using a rotating mirror or prism. **Phase-comparison** systems, while offering similar accuracies to time-of-flight systems, calculate the range to the target slightly differently. A phase-comparison scanner bases its measurement of range on the differences in the signal between the emitted and returning laser pulses, rather than on the time of flight. Phase- comparison systems have much higher rates of data capture (millions of points per minute), which results in a much higher density of point cloud, but can lead to significant pressures on computer hardware in subsequent processing (Figure 2.). **Airborne laser scanners** use laser scanning equipment based on time-of-flight or phase-comparison principles. However, it is also necessary to couple the laser scanner with GNSS and inertial sensors to measure the position, orientation and attitude of the aircraft during data collection. By combining these measurements with the range data collected by the laser scanner a three-dimensional point cloud representing the topography of the land is produced, much like that generated from a ground - based static scanner. Another recent technological development is in **mobile mapping**, which involves mounting one or more laser scanners and/ or cameras on a vehicle in combination with direct positioning and orientation sensors. These systems are generally used for mapping highways or producing city models, although they have also been used in a variety of applications such as in the efficient surveying of beach and cliff profiles [12].

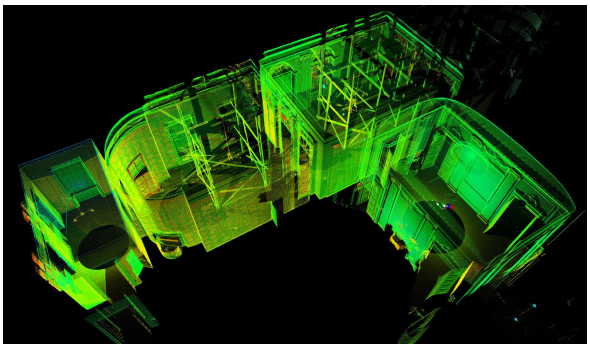

Figure 2. A drawing generated from laser scanning data and narrative imagery, section (courtesy of Michele Curuni)

The result of 3D laser scanning is point cloud from which it is possible to complete technical documentation with software (Figure 3.). The software must match the laser station that was used during the scanning. The accuracy of this mapping is an extraordinary. Laser scanning solutions, surveyors and reality capture technicians around the world are able to measure and point cloud with millimetric precision and high resolution any historic monument or building. Millions of points are converted into 3D models that allow specialists to understand how structures were built and what are the current conditions and threats they face [4].

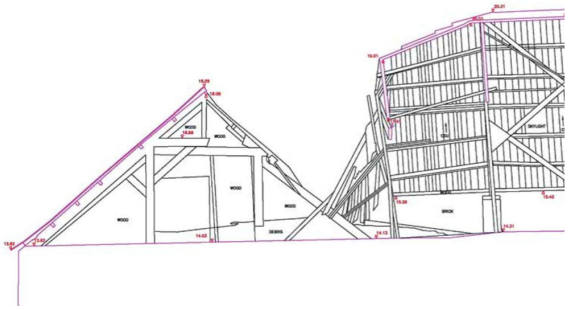

Figure 3. A drawing generated from laser scanning data and narrative imagery (courtesy of Tony Rogers, APR Services) [12]

By applying this method, it is possible to determine with great accuracy the position, type and degree of damage, and in accordance with that, it is also possible to choose appropriate measures of protection. Formed documentation with this precision is the base for restoration and reconstruction of threatened structures, but also opportunity to rebuild them in case of their total destruction.

IV. CONCLUSION

In order to mitigate consequences of natural hazards, different measures have to be taken in advance. Permanent active and passive mitigation measures are the best response to the risk. Therefore, usage of photogrammetry and laser scanning can be helpful in spatial planning and land-use activities, as well as tool in approach of technical measures for remediation on cultural heritage sites. Serbia is country where all research which includes rectification of rich architectural

sites is based on classical methods, for that reason there is a lot of room for fresh progress and improvements. Utilization of modern technologies for the purpose of preservation of cultural heritage sites has to be priority, in order to protect the legacy of human beings on the planet.

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Simulation of Queuing System based on Anylogic

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Abstract - In this paper, we use the operations research's queuing theory to analyze the service process in queueing system and use AnyLogic simulation software to do modeling. We consider queuing system with Poisson input flow, exponential service time and infinite capacity of system. (There are an *M*/*M*/1and *M*/*M*/*n* systems). The accuracy of the experiment data is verified by doing comparisons with theoretical values.

I. INTRODUCTION

Queuing is the most common phenomenon in everyday life. It is common to see a large number of persons waiting in a bank, market, railway station or in a theatre to have some service carried out.

Computer simulations is a useful tool for the mathematical modeling of many natural systems. Computer simulations build on, and are a useful adjunct to mathematical models in Computer Science, Computing Science, Probability Statistics , Operations Research and so on. Through establishing mathematical models and simulating by computer, the original issue can be solved by using simulation result as approximatively solution.

Simulation can be used as a tool for predicting the effect of changes to existing systems and as design tool to predict the performance of new systems. Simulation techniques have advantages and disadvantages, so that make it impossible to receive a clear answer at the question when to use simulation.

Computer simulation is used often in the analysis of queueing system.

Queueing system are systems which have need of system resources. When resources are not available, those who need that resources, will wait for them to be available. Examples of these kind of systems include clients who requires bank teller services, customers who pays on supermarket, computer system processes that are waiting on a central processing unit, etc.

Queuing systems was studied by mathematical methods. But, with development of computer simulation techniques, queuing systems can be studied by simulation.

Authors in [3] attempts to investigate and suggest the best possible configuration for a bank in Malaysia through constructing computer–based simulation models. As the result of their study, the final suggested configuration shows improvement in terms of average utilization rate of counters and average waiting time that customers have to spend in the queue.

In [7], based on Anylogic6.0 simulation software, some simulation models of queuing systems with different queuing disciplines are established, including First Come First Service, Last Come First Service and Random Service. Compared with the theoretical values, the accuracy of the experiment data is verified. Also, with Comparative Analysis of experiment data, in [7] is showed that under a special condition, the difference of the performance of the queuing systems with different queuing disciplines is limited.

In [6] is analyzed the queuing system with finite capacity *M*/*M*/*n*/*m*. Additionally demonstration of simulation of the market as example of $M / M / n / m$ queuing system is given.

In [5] is given *M*/*M*/*m* queue and is compare *M*/*M*/1 queue with a fast server operating at $m\mu$ with an *M*/*M*/*m* system. Also is given $M/M/\infty$ queueing system.

The two queuing system's analytical solutions are compared and analyzed, then two queuing system's simulation results are analyzed. After that each kind of queuing system's analytical solution

and the simulation results are compared and analyzed. This is done in paper [4]. Also, in the same paper, it is pointed out that the analytic results and the simulation results are significantly different, and the defects which may exist in analytical solution and the simulation solution also were analyzed.

Document [1] gives an overview of the standard methods used to model and analyze the performance of queuing systems. Includes both analytical techniques and simulation methodology. Attention is restricted to single-queue systems and the *M*/*M*/1 queue is used as an illustrative example regarding analytical work. Simulation is discussed in the setting of the *G*/*G*/1 queue and various sampling-strategies are central to the discussion.

In paper [2] authors use the operations research's queuing theory to analyze the container terminal's service process; and simultaneously use the AnyLogic-based simulation to do modeling. Through the calculation of key indicators, they analyze advantages and disadvantages of the simulation modeling in container terminal logistics application. By changing the ratio of the number of critical facilities, they come up with an effective method to enhance the utilization of port equipment's.

AnyLogic is a very flexible, dynamic simulation tool developed by The AnyLogic Company, suitable for all fields and business areas where simulation methods are commonly applied. This means that AnyLogic supports system dynamics as well as process-oriented (discrete event) and agent-based methodologies.

In order to study on operation efficiency of queuing systems of type M/M/1 and M/M/K with different queuing disciplines, this paper use computer simulation technology to establish some simulation models based on Anylogic6.0 simulation.

II. QUEUEING SYSTEMS

The basic queueing model is shown in Fig 1. (Queueing Systems Ivo Adan and Jacques Resing)

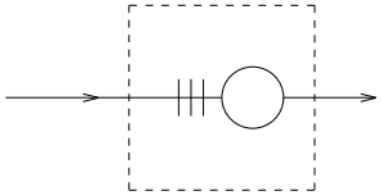

Figure 1. Basic queuing system

Key elements of the queueing systems are the clients and the servers.

Queueing model is characterized by:

- The arrival process of customers.

Usually we assume that the interarrival times are independent and have a common distribution.

- The behavior of customers.

Clients may be patient and willing to wait or clients may be impatient and leave after a while.

- The service times.

Usually we assume that the service times are independent and identically distributed, and that they are independent of the interarrival times.

- The service discipline.

Queuing disciplines have many forms, including First Come First Service, Last Come First Service and Random Service and so on.

- The service capacity.

There may be a single server or a group of servers helping the customers.

The Kendall classification of queuing systems exists in several modifications. The most used classification uses 6 symbols:

$$A/B/s/q/c/p$$

These symbols represent the following characteristics of the system:

A - the distribution of the length of the intervals between two successive arrivals.
B - distribution of service time.
s - is the number of servers.
q - is the queuing discipline (FIFO, LIFO,…)
c - is the system capacity.
p - is the population size (number of possible customers).
In this paper we will regard the following queuing system:

System 1. *M/M/*1 system. For this system, we have Poisson input flow i.e. exponential interarrival times with mean $1/\lambda$, exponential service times with mean $1/\mu$ and a single server.

System 2. *M/M/K* system. For this system, we have Poisson input flow i.e. exponential interarrival times with mean $1/\lambda$, exponential service times with mean $1/\mu$ and *n* servers.

III. *M/M/*1 SYSTEM AND *M/M/K* SYSTEM

*A. M/M/*1 System

M/*M*/1 system is queueing system where arrival distribution of client follows Poisson distribution (arrival rateλ), distribution of service time follows exponential distribution, [8]. The system is composed of 1 server (service rate μ) and unlimited FIFO queue. (Fig 2.).

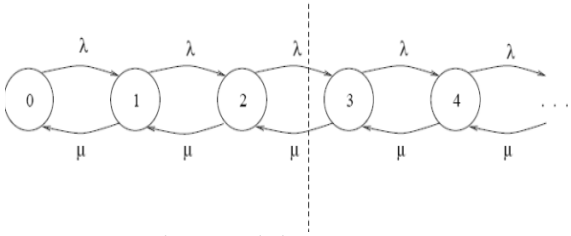

Figure 2. *M*/*M*/1 system

We require that

$$\rho = \frac{\lambda}{\mu} < 1, \tag{1}$$

since, otherwise, the queue length will explode. The quantity is the fraction of time when the server is working. The probability that there are n client in the system is

$$p_n = \rho^n (1-\rho). \tag{2}$$

The probability that there are no clients in the system:

$$p_0 = 1-\rho. \tag{3}$$

The expected number of client in the system is:

$$L = \frac{\lambda}{\mu - \lambda}. \tag{4}$$

The expected number of jobs in the queue is

$$L_q = \frac{\lambda^2}{\mu(\mu-\lambda)}. \tag{5}$$

From the Little's formula, the average time spent waiting in the queue is:

$$W_q = \frac{L_q}{\lambda}, \tag{6}$$

and the average time spent in the system:

$$W = \frac{L}{\lambda}, \tag{7}$$

Applying Little's Formula,

$$W = \frac{1}{\mu - \lambda}, \tag{8}$$

and

$$W_q = \frac{\lambda}{\mu(\mu-\lambda)}. \tag{9}$$

B. M/M/K System

M/*M*/*K* system is queueing system where arrival distribution of client follows Poisson distribution (arrival rateλ), distribution of service time follows exponential distribution, [9]. The system is composed of *K* servers (service rate μ) and unlimited FIFO queue. (Fig 3.)

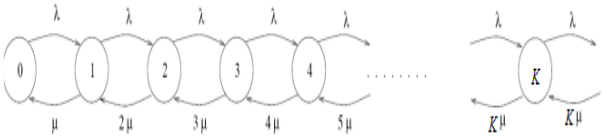

Figure 3. *M*/*M*/*K* system

This system, for any values of λ and μ for which $\rho = \frac{\lambda}{\mu} \neq 1$ may be observed in a stationary regime of work:

$$t \to \infty,\ p_k'(t) = 0,$$
$$p_k(t) = p_k. \tag{10}$$

For this system we apply following formulas:

The server utilization can be obtain with following formula:

$$\rho = \frac{\lambda}{K\mu}. \tag{11}$$

The probability that there are no clients in the system:

$$p_0 = \left[\sum_{i=0}^{K-1} \frac{(K\rho)^K}{K!} + \frac{(K\rho)^K}{K!} \frac{1}{1-\rho} \right]^{-1}. \tag{12}$$

The probability that there are *n* clients in the system

$$p_n = \begin{cases} p_0 \rho \dfrac{1}{n!}, & n < K \\ p_0 \rho \dfrac{1}{K! K^{n-K}}, & n \geq K \end{cases}. \quad (13)$$

Probability of an arriving client finding that all servers are busy is called Erlang - C formula and is given by

$$P_q = P(queueing) = \frac{(K\rho)^K}{K!} \frac{p_0}{1-\rho}. \quad (14)$$

The average number of client in the queue is:

$$L_q = P_q \frac{\rho}{1-\rho}. \quad (15)$$

Average waiting time of clients, in the queue is:

$$W_q = \frac{L_q}{\lambda}, \quad (16)$$

or

$$W_q = P_q \frac{\rho}{\lambda(1-\rho)} = P_q \frac{1}{K\mu(1-\rho)}.$$

Average waiting time of clients, in the system is:

$$W = W_q + \frac{1}{\mu}. \quad (17)$$

Average number of clients in the system is:

$$L = \lambda W. \quad (18)$$

IV. SIMULATION MODEL

In this paper, the queuing systems *M/M*/1 and *M/M/K* with FIFO unlimited queuing disciplines are studied. The simulation model of queueing systems based on Anylogic 7.3.6. is established. It is shown in Fig.4 below:

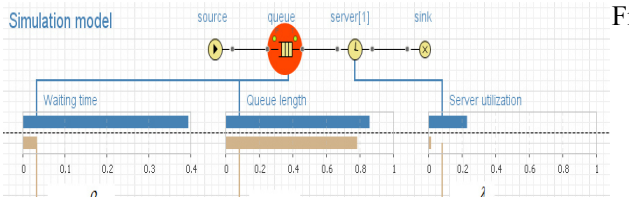

Figure 4. Simulation model of queuing system based on Anylogic 7.3.6

This model contains four objects: source, queue, server and sink. Source Object generates entities according to the need. Queue Object simulates customers queue. Server Object simulates service desk. Sink Object means that the end of the service and the customer leave off. We can shown different number of the servers. (from 1 to 5),

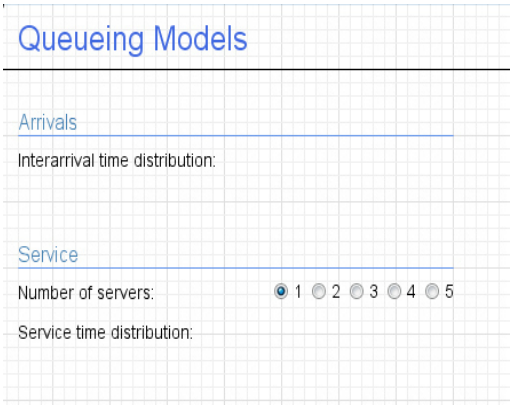

Figure 5. Queueing model

If we choose 1 server then we will consider *M/M*/1 queueing system, otherwise we will consired *M/M/K* queueing system.

With this simulation model we will compute average waiting time of clients in the queue, average number of clients in the system and server utila.

A. *M/M*/1 System

Arrival rate λ represent the number of clients who arrive in one minute. Average service time is the mean time needed to service a client. We assume that the input process is Poisson flow with arrival rate $\lambda = 0.6667$ and the service time is an exponential distribution with service rate $\mu = 1$. We can obtain the average interarrival time as a reciprocal value of the parameter λ ($1/\lambda = 1.5$). Also, we can obtain average service time as a reciprocal value of the parameter μ ($1/\mu = 1$), Fig.6.

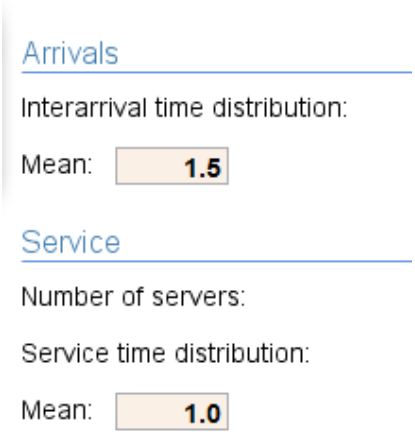

Figure 6. Input parameters

In Fig 7. the result of the simulation are shown:

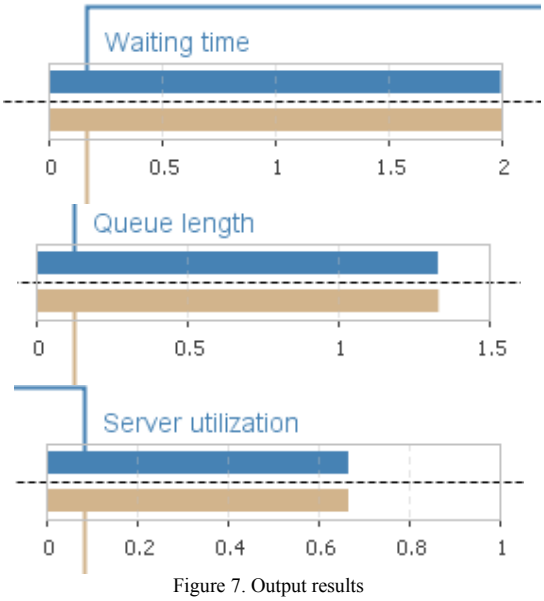

Figure 7. Output results

From Fig 7. we can see that average waiting time in the system is $\overline{W}_q \approx 2$, average number of client in the queue is $\overline{L}_q \approx 1.3$ and server utilization is $\overline{\rho} \approx 0.7$.

B. *M/M/K* System

We assume that the input process is Possion flow with arrival rate $\lambda = 3$ and the service time is a exponential distribution with service rate $\mu = 4$. Average interarrival time is $1/\lambda = 0.333$ and average service time is $1/\mu$. We choose 2 servers.

In Fig. 8, input parametars for *M/M/K* system are given.

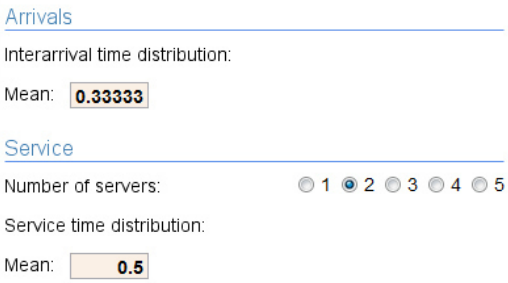

Figure 8. Input parameters

In Fig 9. the result of the simulation are shown:

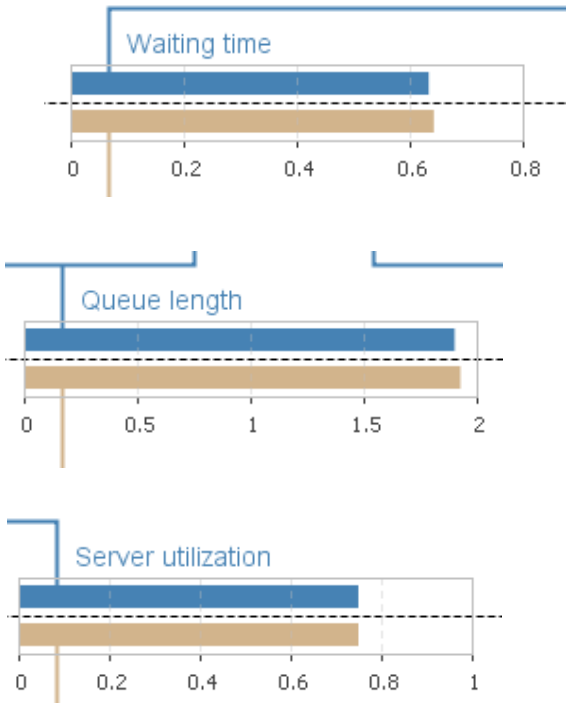

Figure 9. Output results

From Fig 9. we can see that average waiting time in the queue is $\overline{W}_q \approx 0.625$, average number of client in the queue is $\overline{L}_q \approx 1.9$ and server utilization is $\overline{\rho} \approx 0.7$.

V. THE ANALYSIS OF THE SIMULATION RESULTS AND CONLUSION

In this part we will make comparison between results given from simulation and analytical results.

First, we consider, the *M/M/*1 queueing system, with arrival rate $\lambda = 0.6667$ and service rate $\mu = 1$.

From the formula (9), for average waiting time in the queue we obtain:

$$W_q = \frac{\lambda}{\mu(\mu-\lambda)} = \frac{0.6667}{0.3333} = 2{,}0003\,.$$

We can conclude that simulation results $\overline{W}_q \approx 2$ and results which are obtained by analytical model are approximately equal.

For the average number of client in the queue, analytical result is:

$$L_q = \frac{\lambda^2}{\mu(\mu-\lambda)} = \frac{0{,}6667^2}{0{,}3333} = 1{,}3336.$$

We can see that $\overline{L}_q \approx L_q$.

For the system, *M*/*M*/*K* inputs parameter for the simulation are λ = 3 and μ = 2. Server utilization is

$$\rho = \frac{\lambda}{K\mu} = \frac{3}{4} = 0.75.$$

First, we will compute, the probability that there are no clients in the system:

$$p_0 = \left[\sum_{i=0}^{K-1}\frac{(K\rho)^i}{i!} + \frac{(K\rho)^K}{K!}\frac{1}{1-\rho}\right]^{-1}.$$

$$= \left[\sum_{i=0}^{1}\frac{(2\cdot 0.75)^2}{2!} + \frac{(2\cdot 0.75)^2}{2!}\frac{1}{1-0.75}\right]^{-1}$$

$$= \frac{1}{7} = 0{,}143.$$

Probability of an arriving client finding that all servers are busy is

$$P_q = \frac{(K\rho)^K}{K!}\frac{p_0}{1-\rho} = \frac{(2\cdot 0.75)^2}{2!}\frac{0.143}{0.25} = 0.6428.$$

Finally, for W_q we will obtain

$$W_q = P_q\frac{1}{K\mu(1-\rho)} = \frac{0.6428}{2\cdot 2\cdot 0.25} = 0.6428.$$

Average number of client in the queue, we will compute by Little's formula:

$$L_q = \lambda W_q = 3\cdot 0.6428 = 1.9284.$$

We can conclude that simulation results and results which are obtained by analytical model are approximately equal.

$$\overline{W}_q \approx 0.625 \approx 0.6428 = W_q$$

and

$$\overline{L}_q \approx 1.9 \approx 1.9284 = L_q\,.$$

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Importance of Critical Thinking in the Age of Internet

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Abstract – Internet is an endless source of information, and amount of content available is growing daily. You can find all type of information at the end of an Internet search, and sometimes you will find inconsistent stories about the same event. What to do now? How do you decide which story is the correct one? This is where you see how important is critical thinking: how to determine the best answer out of the options provided. This paper will address some of the steps for effective critical thinking and importance of having it as part of education which prepares students for future beyond school.

I. INTRODUCTION

Every day people go to Internet to find out latest news, stock market trends, find out information for their research paper, etc. Internet is a blessing in a sense that provides all this information quickly, and at a small cost. Not so long ago, for a research paper you needed to go to the library to get a book, and then read through hundreds of pages in order to find information you are interested in. And now you just type your search query from comfort of your home, and the search results are providing you with thousands of hits that match your query. However, lately there is a trend of 'alternative facts' observed where people would post content online which is not neccesarily true. After all, no one is censoring the Internet content, there are no editors or proofreaders. You can post literaly whatever you want, and there are people who are taking advantage of this fact for their own benefit. Some incorrect content is a mistake from the side of author, but some are intentional efforts of 'internet trolls' to mislead people. The 'trolls' can do this for several reasons, and some of them are:

- the more people they mislead, the more accomplished they feel; or
- they don't care if content is true or not, or what consequences their incorrect content might have, as long as they generate as many hits as possible, since that is increasing their ad income.

In order to avoid trap of 'alternative facts' people should learn to think critically, to form a habit of getting their stories from multiple sources in order to be able to compare them and to deduct the conclusion which is supported by facts.

II. CLASSIC EDUCATION

In classic education, students learn facts, and get their information by attending classes, and reading from books (or online resources). They reproduce that information in test, and based on the score they pass the exam. This is an approach that relies on students to memorize facts and use them to pass the test and advance to next grade. Their success in school is measured by level of memorizing and reproducing the facts.

This is a system that does not work beyond classroom. Learning does not end with graduation. When you get a job, there are no textbooks where you can read how to face all scenarios. You will need to be able to evaluate situations and solve problems at hand, problems that are not written in a book, or described in a class. For this you will need an ability to find connections between pieces of knowledge and assess the situation; to judge what information is relevant and discard data that is not useful; to weigh various facts and points of view and identify logical errors [1]. You will need a skill called critical thinking.

III. CRITICAL THINKING

Critical thinking has many definitions, but they all emphasize clarity and rationality. One of them defines critical thinking as making clear, reasoned judgment; and during the process of critical thinking ideas should be reasoned, well thought off, and judged [2].

Critical thinking can be described with the following steps:

1. Evaluate what you hear or read. Spend some time asking questions: "why?", "what are pros and cons?", "how?", "is that a fact or an opinion?"
2. Gather information: check additional sources, consider alternatives. Do step #1 for any different information you acquire.
3. Don't assume you are right, and keep an open mind for alternative outcome. Don't allow your existing biases to block you from considering other options.
4. Draw conclusions from the gathered evidence and create solutions. Weigh the advantages and disadvantages of each alternative. Consider: cost, benefits, consequences, obstacles, etc.
5. Select an option that best serves your goals, and put it into action (if applicable); monitor the results of your approach, make adjustments if needed.

Critical thinking is not easy. It involves keeping an open mind related to what you want to believe, and embracing other information [3]. It requires you to be reflective about your reasoning, and to make a consious effort to avoid biases, and maintain objectivity[4].

With critical thinking we see that knowledge is fluid and builds upon itself. It is essential for problem solving, and encourages people to think for themselves, to ask questions, develop alternative hypotheses, and to test them against known facts [5].

Critical thinking is a meta-skill that applies to all aspects of life. It is necessary for people to form their own informed opinions, to think clearly and rationally in order to be considered as educated and successful individuals at work and in life in general.

IV. IMPORTANCE OF CRITICAL THINKING

In today's age of information, unless you plan to get a low paying job doing repetitive tasks, it is expected that you will need to solve problems and make informed decisions, individually or as a part of the team. Looking at descriptions of jobs posted, increasing number of jobs list critical thinking as a requirement, and you can see it for a variety of job titles, such as: nurses, managers, softare engineers, lab technicians, etc.

When looking for long term employees who can make an impact for the company, employers don't need employees who only do as told, but they look for people who will use their brains to make decisions, innovate and improve existing solutions. Good employees don't require micromanaging. They can make good decisions on their own, based on data gathered and current business priorities. Those employees have skills such as problem solving, and making logical decisions; critical thinking is an essential part of these skills [6].

V. CRITICAL THINKING IN EDUCATION

In schools, teachers help students to learn and apply concepts through instruction, presentation and guidance. Students learn different skills in their classes working with their teacher, by themselves, or in a group setting with their peers. It is obvious that solving problems in certain areas, such as mathematics and science requires critical thinking, but if a student can solve problems independently and systematically, he can do well in all subjects, not just in math and science [1].

Critical thinking is a skill that needs to be learned and practiced. Just as any other skill it gets more polished the more it's practiced. That is why students should learn about critical thinking, and start using it as soon as possible, because of this critical thinking should be taught in schools.

The question is: what is the most effective way to teach it? As a separate subject on its own, or in combination with other subjects? The answer to this question is: probably both. Students should learn about critical thinking, in order to grasp the concepts of what critical thinking is, and how and why to use it, as well as the benefits of it. This will allow them to make deliberate effort to apply critical thinking and master it. Besides learning about critical thinking, it needs to be practiced, and this can be accomplished by applying it as part of other subjects. There are many ways in which critical thinking can be practiced, e.g. as part of individual research topics or group discussions.

There are online sources for teachers who want to learn and teach critical thinking, as well as to have it as integrated part of their subjects, and one of those resources is: www.reasoninglab.com.

VI. CONCLUSION

In today's age of information and technology, successful individual needs to be able to deal with changes quickly and effectively in an informed manner. The economy is placing increasing demands on flexible skills, and problem solving. Critical thinking promotes such skills.

Critical thinking helps people to find their own truth, and not just accept information which they read online from some article or from social media. It will be difficult for 'internet trolls' to deceive audience, if we increase number of people

who effectively use their critical thinking skills and debunk fake information.

The more we use critical thinking, it will become more as a second nature. Educators should put a priority in emphasizing critical thinking as a skill that needs to be learned and applied through all grades, and courses taken. Critical thinking is a skill that will help students be prepared for a success in school, as well as a successful life after school.

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Two-layer Quality Analysis of University Study Program Subjects Using DEA and AHP

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Abstract; One of the most important pillars in the society (every possible state in the world) is the education system, especially the higher education. It is known as the basic generator of knowledge and starter of all future progress and system development. Thus, it is very important to put guarantees as much as it is possible that the products from the educational processes will ensure quality future in every aspect of our living. Having this in mind, it is necessary to have permanent approach of measuring the performances of the education system, find all pros and cons and locate the efficient and inefficient parts of the mosaic, so it is possible to suggest steps for improvement in order to have better graduates and future academic citizens and overall, better skills and knowledge delivery during the studies.

Of course, conduction of the education (and having knowledge as output) requires certain investments of resources (teachers, equipment, conditions), that can be treated as input. In such manner, we build a system / model for measuring the output/input ratio using specific LP technique known as Data Envelopment Analysis (DEA) that can give good perspective of efficiency of the study process. Furthermore, in the pool of the efficient parts of the model we examined, we do another more analysis using Analytical Hierarchical Process (AHP) method in order to find "the best of the best" parts. More specific, our system is the specific university study program. The constituent elements that we do our examination over are the study program courses.

I. INTRODUCTION

Optimization is mathematical approach that can often give good answer to the question how to find the best of the offered / possible alternatives to solve a speciffic problem. In other words, it gives an answer to the question which option is the most efficient, among all of the options available. Thus, in terms of linear programming (LP), it is necessary to build a precise mathematical model that will reflect the real problem in a best way. If a particular problem that is being analyzed is presented as a mathematical model reflecting certain real production (objective) function, the problem boils down to determining the optimum (minimum or maximum) value of the same. It must describes the reality as an input/output system, with inputs and outputs - real values (variables) with their own characteristics and limitations, used to mathematically sketch the objective function. DEA represents LP tool that pictures the problem as an input/output system, composed of a specific number of production units, that threats the inputs and produce the outputs. The goal is to find the best production (best allocation of inputs for best output) and to give a clear picture what shoud be changed to the other production units, in order to improve them. In this analysis, we examine the courses of a specific university study program as input/output systems and use DEA to find the efficient ones. Furthermore, AHP is applied to the efficient courses to find their internal efficiency scaling and thus to deepen the research and double the weigth of the results. It is important to note that the justification for the use of both DEA and AHP methods on practically the same problem, lies in the fact that they successfully deal with patterns and problems involving heterogeneous and quite different in nature parameters and criteria to decide, as in this study.

A. DEA Mathematics

Modeling of the real word in DEA terms means having:

- Set of production units – input/output systems – known as DMUs (Decision Making Units), in this examination – university study program courses;
- Input parameters (same for all DMUs), in this examination investments for each course;
- Output parameters (same for all DMUs), in this examination the results of study program conduction in terms of knowledge and skills gathered from the students;
- Technical efficiency (the goal of the examination) of a single DMU is defined as:

$$\theta = \frac{Output}{Input}$$

It is called ***Pareto*** efficiency in case of best resources allocation (usually inputs) in the examined set of DMUs. The DMU with Pareto efficiency is called **efficient** DMU (in this paper – efficient course). The

other DMUs are relatively inefficient (only in the observed set of DMUs). It is not possible for the efficient DMUs to change something in order to achieve better performances to the efficient DMUs (it is impossible to improve the output without worsening the input).

Having n DMUs with m inputs and s outputs each, the efficiency of k-th DMU is:

$$\theta_k = \frac{u_1 y_{1k} + u_2 y_{2k} + \cdots + u_s y_{sk}}{v_1 x_{1k} + v_2 x_{2k} + \cdots + v_m x_{mk}}$$

where $x_{1k}, x_{2k}, \ldots, x_{mk}$ are the inputs of the k-th DMU, $y_{1k}, y_{2k}, \ldots, y_{sk}$ are the outputs of the k-th DMU, $v_1, v_2, \ldots, v_m$ are inputs' weight coefficients and $u_1, u_2, \ldots, u_s$ are outputs' weight coefficients, with mathematical limitation (in connotation of the reality):

$$v_1, \ldots, v_m \geq 0, u_1, \ldots, u_s \geq 0,$$

In this paper, we use DEA CCR CRS input oriented model:

- Goal:
  $max\ (\theta_k = \frac{u_1 y_{1k} + u_2 y_{2k} + \cdots + u_s y_{sk}}{v_1 x_{1k} + v_2 x_{2k} + \cdots + v_m x_{mk}})$,
- Limitations:

$$\frac{u_1 y_{11} + u_2 y_{21} + \cdots + u_i y_{s1}}{v_1 x_{11} + v_2 x_{21} + \cdots + v_m x_{m1}} = \frac{\sum_{i=1}^{s} u_i y_{i1}}{\sum_{j=1}^{m} v_j x_{j1}} \leq 1$$

$$\ldots$$

$$\frac{u_1 y_{1k} + u_2 y_{2k} + \cdots + u_i y_{sk}}{v_1 x_{1k} + v_2 x_{2k} + \cdots + v_m x_{mk}} = \frac{\sum_{i=1}^{s} u_i y_{ik}}{\sum_{j=1}^{m} v_j x_{jk}} \leq 1$$

$$\ldots$$

$$\frac{u_1 y_{1n} + u_2 y_{2n} + \cdots + u_s y_{sn}}{v_1 x_{1n} + v_2 x_{2n} + \cdots + v_m x_{mn}} = \frac{\sum_{i=1}^{s} u_i y_{in}}{\sum_{j=1}^{m} v_j x_{jn}} \leq 1$$

$$v_1, \ldots, v_m \geq 0, u_1, \ldots, u_s \geq 0;$$

$$x_{ij} \geq 0, y_{rj} \geq 0; i = 1, \ldots, m; r = 1, \ldots, s; j = 1, \ldots, n.$$

The result are weights that maximizes each DMU's efficiency in respect of all the other DMUs, forming frontier line consisted of best DMUs with efficiency = 1 (**efficient DMUs)**. All inefficient DMUs have efficiency below 1 and are called **inefficient**.

Often, as in this paper, the dual DEA CCR model is used:

- Find $min\theta$
- Having limitations:

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{i0}, \quad i = 1, \ldots, m$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0}, \quad r = 1, \ldots, s$$

$$\lambda_j \geq 0, \quad j = 1, \ldots, n$$

index 0 is for each DMU that equitations are solved for separately (in order to maximize its efficiency), lambdas represent weighted coefficients that build the composite DMUs for each inefficient DMU (shows possible ways for improvement). The composite DMU for each inefficient real DMU is consisted as sum of the ERS (efficiency reference set – efficient DMUs) multiplied with its lambda coefficients. If A and B are efficient DMUs (m inputs, s outputs) and belong to the ERS set of observed inefficient C DMU, the composite DMU C' can be calculated as:

$$\lambda_A \begin{bmatrix} y_{1A} \\ \ldots \\ y_{sA} \\ x_{1A} \\ \ldots \\ x_{mA} \end{bmatrix} + \lambda_B \begin{bmatrix} y_{1B} \\ \ldots \\ y_{sB} \\ x_{1B} \\ \ldots \\ x_{mB} \end{bmatrix} = \begin{bmatrix} y_{Composite} \\ \ldots \\ y_{Composite} \\ x_{Composite} \\ \ldots \\ x_{Composite} \end{bmatrix}$$

B. AHP Mathematic

AHP is an approach for decision making that involves structuring multiple choice criteria into a hierarchy, assessing the relative importance of these criteria, comparing alternatives for each criterion and determining an overall ranking of the alternatives. AHP helps to capture both subjective and objective evaluation measures, proving a useful mechanism for checking the consistency of the evaluation measures and alternatives suggested by the team, thus reducing bias in decision making. In the following text we show the base AHP step methodology.

Step 1: Perform Pair – wise Comparison according Saaty nine – point preference scale.

Table 1. Saaty's Nine – Point Preference Scale

Scale	Compare factor of I and j
1	Equally Important
3	Weakly Important
5	Strongly Important
7	Very Strongly Important
9	Extremely Important
2,4,6,8	Intermediate value between adjacent scales

Let A represents $n \times n$ pair – wise comparison matrix:

$$A = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ a_{21} & 1 & \cdots & a_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ a_{n1} & a_{n2} & \cdots & 1 \end{bmatrix}$$

Step 2: Normalize the raw score by Arithmetic Mean as given below:

$$n_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}}, \quad j = 1,2,\cdots,n$$

Step 3: Perform Consistency check.
Step 3a: Let C denotes a n – dimensional column vector describing the sum of the weighted values for the importance degrees of the attributes, then

$$C = [C_i]_{nx1} = AW^T, \quad i = 1,2,\cdots,n$$

Step 3b: To avoid inconsistency in the pair – wise comparison matrix, Saaty suggested the use of the maximum Eigen value $\lambda_{\max}$ to calculate the effectiveness of judgement. The maximum Eigen value $\lambda_{\max}$ can be determined as follows:

$$\lambda_{max} = \frac{\sum_{i=1}^{n} c \cdot v_i}{n}, \quad i = 1,2,\cdots,n$$

Step 3c: With $\lambda_{\max}$ value, a consistency index (CI) can then be estimated by

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Step 3d: Consistency ratio (CR) can be used as a guide to check the consistency

$$CR = \frac{CI}{RI}$$

Where RI denotes the average random index with the value obtained by different orders of the pair – wise comparison matrices are shown in Table 1. The value of $CR \leq 0.10$ is the consistent criteria.

II. PROBLEM, MODEL, GOAL

The starting approach and modeling of the real world is based on forming the input of parameters whose increase will reduce the DMU's efficiency and output of parameters whose increase will increase the DMU's efficiency (in natured of the input oriented DEA CCR CRS). The modeling concentrates on the university study course that aggregates investments of the resources as input parameters (teachers' costs, equipment costs and number of classes held) and produces types of skills and knowledge as output parameters. Model can be pictured as:

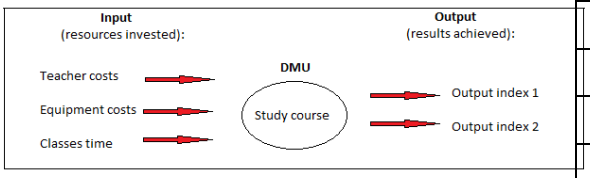


Figure 1. Model for DEA appliance

A. *Input/output definition*

The model is applied on study program of informatics (Faculty of Informatics, Goce Delcev University in Stip, RM, generation 2007), at 24 courses from all the semesters.

Input is consisted of:

- Number of classes held - classes load is often very important issue in terms of study program structuring, forming groups of students and organizing the real implementation of the course – **time component of the model**.
- Expenses that University had with equipment and inventory used for this study program. This is done by calculation of the degree of utilization in accordance with their gross purchase price and the legislation and considering the percentage of load / utilization in terms of number of students of the observed course and all students that used the same equipment – **material component of the model.**
- Expenses that University had of hiring professors and assistants, calculated in terms of gross salaries with consideration of the semester length (period of knowledge delivery) and the percentage of load in terms of number of students of the observed course and all students that the concrete teacher covered – **material component of the model.**

Output is consisted of:

- Index of the level of contribution of each course in skills, competencies and knowledge delivery, prescribed with the accreditation elaborate of the study program (**Index 1**). It is done through a massive survey and based on the official documents.
- Index of the quality of skills, competencies and knowledge delivered (**Index 2**) through the study program. This parameter, represented by the average grade of each course is calculated using the powerful e-index platform of Goce Delcev University, fully automated for students' e-administration.

B. *Total numbers and final DEA model*

The numerical DEA model is represented with table 2:

Table2. DEA model

(1)	(2)	(3)	DMUs / Courses	Index 1	Index 2
24	28737,71	83066,86	English language 1	3,5714285715	9,0227
168	31190,88	12225 3,1	Electrical engineering	3,910742855	7,8181
252	28737,71	87609,05	Math 1	3,928571429	7,1705
168	31190,88	10563 4,6	Programing	4,267857143	6,8522
24	25154,8	79832,87	English language 2	3,5714 28572	8,8160
252	24766,98	10147 3,2	Linear algebra	3,875	7,5568
252	27093,87	10147 3,2	Math 2	3,982171427	7,0795
168	27093,87	10727 6,6	Objective programing	4,267857143	7
108	31979,06	36434,47	Probability and statistics	3,7857 14286	6,943181
96	31979,06	78218,35	Digital logic	4,2857 14286	7,1136
60	21848 1,7	51455,4	Operational systems	3,875	7,7045
96	21848 1,7	13131 4	Software processes	3,964285714	7,2954
96	21848 1,7	11740 7,6	Data structures and algorithms	4,25	6,9545
96	15410 4,2	18727 3,8	Computer architecture	3,678571429	7,1477
96	22734 2,5	62070,34	Data bases	4,3214 28572	7,318181

72	11895 4,8	65492	Internet programing	4,3392 85715	7,2386
72	12381 ,86	62527 ,75	Microprocessors	3,5714 28572	6,7954
72	13413 ,68	64872 ,67	Software analysis and modeling	3,9285 71429	7,125
48	12886 7,7	65273 ,13	Graphics and visualization	4,1607 14286	8,1704
72	12886 7,7	95668 ,31	Multimedia	3,9821 42857	7,6931
72	87132 ,91	64428 ,28	Visual programing	4,3392 85715	7,0568
72	7203, 188	90306 ,62	Intelligent systems	4,1428 57143	7,6931
72	7536, 731	67004 ,76	Distant learning systems	3,1964 28572	7,6022 7
72	7536, 731	57935 ,99	Software projects management	3,8214 28571	7,0113

III. DEA RESULTS

With processing of the input and output parameters in DEA software solution (there are many available open source applications that can be used for this purpose), results give picture of efficient and inefficient courses:

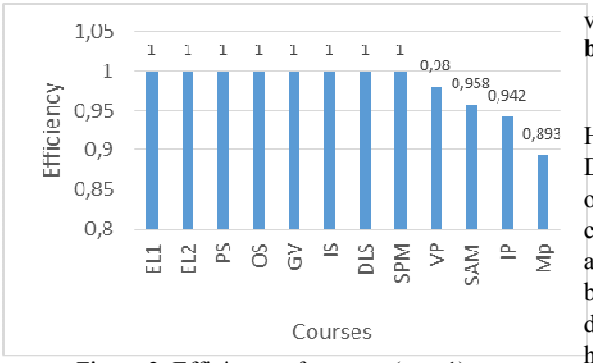


Figure 2. Efficiency of courses (part 1)

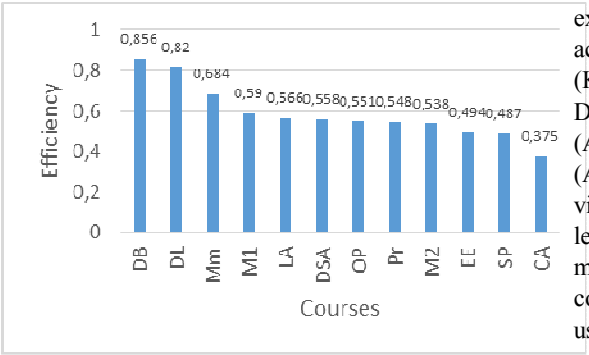


Figure 3. Efficiency of courses (part 2)

Courses with efficiency = 1 are noted as relativly efficient courses and are set of representative courses for the courses with efficiency bellow 1, noted as inefficient courses. Most efficient courses are used in most of the cases of composite courses. Table 3 shows number of use of every efficient course (consisting Efficiency Reference Set – ERS) in creating composite courses.

Table3 . ERS Courses (DMUs)

ERS Courses	Number of times used
English language 1	0
English language 2	6
Probability and statistics	**12**
Operating systems	2
Graphics and visualization	**10**
Intelligent systems	0
Distance learning management	0
Software projects management	**16**

Three courses are used most often in creating composite units: Software projects management, Probability and statistics and Graphics and visualization. This means that they form the "best" part of the frontier, or that they have the best resource allocation in this conditions and constellations. It is very interesting that it gives the **first "best from the best"** picture.

IV. AHP RESULTS

Having the first pool of efficient courses located with DEA at the first layer, we additionally applied AHP in order to sketch scaling of those courses (summary, eight courses) hand find the most efficient one (DEA treats all the efficient courses at same level). In this approach, both inputs (three) and outputs (two) are used as decision criteria in AHP application: Number of classes held (time component) (K1), Inventory and equipment expenses (K2), Teachers and assistants engagement expenses (K3), Level (index) of skills and knowledge achieved (K4) and Average study success (grades) (K5). The AHP alternatives are pictured in the eight DEA located efficient courses: English language 1 (A1), English language 2 (A2), Probability and statistics (A3), Operational systems (A4), Graphics and visualization (A5), Intelligent systems (A6), Distant learning systems (A7) and Software projects management (A8). Results from the expert analysis conducted are given in following. Abbreviations are used in the following text, respectively K1 to K5 for the criteria and A1 to A8 for the alternatives.

Table 4 shows estimates (judgments) and weights of criteria for selection with respect to the goal. Since, it can be seen that best ranked criteria with respect to the goal is the first criterion Number of classes held (lectures and exercises). Maximal eigenvalue λ_{max} is 5,065, consistency index CI is 0,016, consistency ratio

CR is 1,47%, because is lower than 10% level of inconsistency is accepted.

Table 4.Pairwise comparison matrix of the main criteria and weights with respect to the goal.

	K1	K2	K3	K4	K5	Weights
K1	1	3	2	4	2	0,3758
K2	1/3	1	1/2	1	1/2	0,106
K3	1/2	2	1	2	1/2	0,1759
K4	1/4	1	1/2	1	1/3	0,0918
K5	1/2	2	2	3	1	0,2505
Sum	2,58333	9	6	11	4,333333	

Table 5 shows estimates (judgments) and weights of alternatives for selection with respect to the first criterion Number of classes held (lectures and exercises). Since, it can be seen that best ranked alternative with respect to the first criterion is A1 (English language 1). Maximal eigenvalue λ_{max} is 8,649, consistency index CI is 0,092, consistency ratio CR is 6,62%, because is lower than 10% level of inconsistency is accepted.

Table 5. Pairwise comparison matrix for the alternatives and weights with respect to the first criterion.

	A1	A2	A3	A4	A5	A6	A7	A8	Weights
A1	1	3	6	5	5	7	4	7	0,3956619
A2	1/3	1	1	1	1	2	2	1	0,1002597
A3	1/6	1	1	2	1	2	2	3	0,1149405
A4	1/5	1	1/2	1	1	3	2	5	0,118669
A5	1/5	1	1	1	1	1	2	1	0,0862056
A6	1/7	1/2	1/2	1/3	1	1	3	1	0,0705822
A7	1/4	1/2	1/2	1/2	1/2	1/3	1	2	0,0585274
A8	1/7	1	1/3	1/5	1	1	1/2	1	0,0551536
Sum	2,43571	9	10,833	11,033	11,5	17,33	16,5	21	

Table 6 shows estimates (judgments) and weights of alternatives for selection with respect to the second criterion Inventory and equipment expenses. Since, it can be seen that best ranked alternative with respect to the second criterion is A1 (English language 1). Maximal eigenvalue λ_{max} is 8,833, consistency index CI is 0,119, consistency ratio CR is 8,51%, because is lower than 10% level of inconsistency is accepted.

Table 6. Pairwise comparison matrix for the alternatives and weights with respect to the second criterion.

	A1	A2	A3	A4	A5	A6	A7	A8	Weights
A1	1	3	3	5	5	3	2	5	0,3120172
A2	1/3	1	1	1	2	2	3	1	0,1212842
A3	1/3	1	1	2	3	4	2	3	0,1624815
A4	1/5	1	1/2	1	3	3	2	3	0,128012
A5	1/5	1/2	1/3	1/3	1	1	2	3	0,0774697
A6	1/3	1/2	1/4	1/3	1	1	3	1	0,0762466
A7	1/2	1/3	1/2	1/2	1/2	1/3	1	2	0,068037
A8	1/5	1	1/3	1/3	1/3	1	1/2	1	0,0544518
Sum	3,1	8,33333	6,9167	10,5	15,83333	15,33	15,5	19	

Table 7 shows estimates (judgments) and weights of alternatives for selection with respect to the third criterion Teachers and assistants engagement expenses. Since it can be seen that best ranked alternative with respect to the third criterion is A1 (English language 1). Maximal eigenvalue λ_{max} is 8,756, consistency index CI is 0,108, consistency ratio CR is 7,72%, because is lower than 10% level of inconsistency is accepted.

Table 7. Pairwise comparison matrix for the alternatives and weights with respect to the third criterion.

	A1	A2	A3	A4	A5	A6	A7	A8	Weights
A1	1	3	1	2	5	3	2	7	0,2520387
A2	1/3	1	2	1	2	4	3	5	0,1814465
A3	1	1/2	1	2	4	1	2	3	0,1613851
A4	1/2	1	1/2	1	3	3	2	6	0,1537709
A5	1/5	1/2	1/4	1/3	1	1	2	1	0,0623664
A6	1/3	1/4	1	1/3	1	1	3	1	0,0839693
A7	1/2	1/3	1/2	1/2	1/2	1/3	1	1	0,0590377
A8	1/7	1/5	1/3	1/6	1	1	1	1	0,0459855
Sum	4,00952	6,78333	6,5833	7,3333	17,5	14,33	16	25	

Table 8 shows estimates (judgments) and weights of alternatives for selection with respect to the fourth criterion Level (index) of skills and knowledge achieved. Since it can be seen that best ranked alternative with respect to the fourth criterion is A1 (English language 1). Maximal eigenvalue λ_{max} is 8,740, consistency index CI is 0,105, consistency ratio CR is 7,55%, because is lower than 10% level of inconsistency is accepted.

Table 8. Pairwise comparison matrix for the alternatives and weights with respect to the fourth criterion.

	A1	A2	A3	A4	A5	A6	A7	A8	Weights
A1	1	3	1	1	5	5	4	7	0,2473579
A2	1/3	1	2	1	4	4	5	5	0,1934338
A3	1	1/2	1	3	4	1	4	7	0,1937946
A4	1	1	1/3	1	3	3	2	6	0,1498853
A5	1/5	1/4	1/4	1/3	1	1	2	3	0,0583908
A6	1/5	1/4	1	1/3	1	1	3	5	0,0866942
A7	1/4	1/5	1/4	1/2	1/2	1/3	1	3	0,0472271
A8	1/7	1/5	1/7	1/6	1/3	1/5	1/3	1	0,0232163
Sum	4,12619	6,4	5,9762	7,3333	18,83333	15,53	21,333	37	

Table 9 shows estimates (judgments) and weights of alternatives for selection with respect to the fifth criterion Average study success (grades). Since it can be seen that best ranked alternative with respect to the fifth criterion is A1 (English language 1). Maximal eigenvalue λ_{max} is 8,580, consistency index CI is 0,0,82, consistency ratio CR is 5,93%, because is lower than 10% level of inconsistency is accepted.

Table 9. Pairwise comparison matrix for the alternatives and weights with respect to the fifth criterion.

	A1	A2	A3	A4	A5	A6	A7	A8	Weights
A1	1	2	1	1	3	2	4	5	0,2002668
A2	1/2	1	2	1	2	2	5	7	0,1865907
A3	1	1/2	1	3	1	2	4	7	0,1840198
A4	1	1	1/3	1	3	1	3	6	0,1511288
A5	1/3	1/2	1	1/3	1	2	2	5	0,1065591
A6	1/2	1/2	1/2	1	1/2	1	3	5	0,0996851
A7	1/4	1/5	1/4	1/3	1/2	1/3	1	4	0,0488041
A8	1/5	1/7	1/7	1/6	1/5	1/5	1/4	1	0,0229454
Sum	4,78333	5,84286	6,2262	7,8333	11,2	10,53	22,25	40	

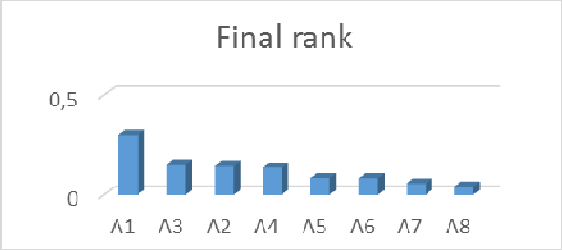
Table 10 summarizes the calculations for obtaining the final order which of the subjects is the most efficient and which is least efficient.

TABLE 10. Summing to obtain the final result

		A1	A1 x K	A2	A2 x K	A3	A3 x K	A4	A4 x K	A5	A5 x K	A6	A6 x K	A7	A7 x K	A8	A8 x K
K1	0,4	0,4	0,1487	0,10026	0,038	0,11	0,0432	0,1	0,0446	0,1	0,03239	0,1	0,02652	0,06	0,022	0,055154	0,021
K2	0,1	0,3	0,0331	0,12128	0,013	0,16	0,0172	0,1	0,0136	0,1	0,00821	0,1	0,00808	0,07	0,0072	0,054452	0,006
K3	0,2	0,3	0,0443	0,18145	0,032	0,16	0,0284	0,2	0,0271	0,1	0,01097	0,1	0,01477	0,06	0,0104	0,045985	0,008
K4	0,1	0,2	0,0227	0,19343	0,018	0,19	0,0178	0,1	0,0138	0,1	0,00536	0,1	0,00796	0,05	0,0043	0,023216	0,002
K5	0,3	0,2	0,0502	0,18659	0,047	0,18	0,0461	0,2	0,0379	0,1	0,0267	0,1	0,02497	0,05	0,0122	0,022945	0,006
Sum			0,299		0,147		0,153		0,137		0,0836		0,0823		0,056		0,042

Following the analysis and calculations using AHP method, it can be concluded that the most efficient course is English language 1 and less efficient one is Software projects management. The final ranking of the courses is show in figure 4.

Figure 4. Final rank for the most efficient subject



This combined application of both AHP and DEA methods allow obtaining clear ranking of courses and addressing the lack of equally effective courses that appeared after obtaining to the results of the application of the DEA technique.

V. CONCLUSION AND DISCUSSION

In this paper we developed integrated approach based on DEA and AHP methodologies. The purpose of the application of these two techniques was to determine the most efficient courses of study program in Informatics. For this goal, DEA technique is initially applied, using resources invested in terms of material and time component as input. Furthermore, output is consisted of the outcome of study program conduction, such as knowledge and its quality gained. The DEA results gives clear picture of summary eight equally efficient courses. To overcome this condition of equally effective courses and getting a more accurate ranking of courses, AHP method was applied. As selection criteria, AHP used inputs and outputs from DEA DMU's. Alternatives which the election was conducted over were those eight equally efficient courses. After corresponding calculation, we obtained final ranking that shows the inequality between equals. In the final order the most efficient course was English language 1 and the least efficient was Architecture of computers.

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C# Encirclement Development in Secondary School Level Education

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Abstract – C# encirclement development in secondary school level education will be analyzed in the framework of this paper. Education in IT is usually linked to colleagues and faculties; however practice has shown that training future IT experts should start earlier even in secondary schools. So, secondary schools have recognized this need. The goal of this research is to establish the schools where C# is more used, the subjects that have C# topics, as well as how much the students are acquainted with the application and use of these surroundings for different purposes. Students and teachers of secondary schools and grammar school in Vrsac were the sample population for the research that has led to the conclusions. On the base of the collected data it can be concluded that in secondary vocational schools 75% teachers and 50% students use C# encirclement development. 25% teachers and 25% students use C# encirclement development in grammar schools.

I. INTRODUCTION

The educational profiles that study programming languages mainly one school year are computer electro-technician, electronic electro-technician, computer control technicians, grammar schools, and etc. In these secondary schools only one programming is taught that represents base for applying various application software for a certain educational profile. But, students who complete secondary school education cannot find a suitable employment for they do not have enough knowledge in programming. [1].

The programming languages are learnt with the aim to use the acquired knowledge in producing various applications. Programming languages such as C#, Java, Python, C++, Objective C, PHP, JavaScript are used to produce applications for different purposes such as: system programming, Web application production, desktop applications, mobile application, and Web-client application. It can be concluded that some programming languages are multi-purposes and it is better to choose them for studying [1].

II. THEORETICAL APPROACH TO THE PROBLEM

The company Tiobe Software releases a survey of most used programming languages in the world every month. The five most used programming languages Java, C, C++, C# and Python. TIOBE Programming Community list is an index of most used programming languages for the month that has been analyzed [2].

Figure 1 shows the most frequently used programming languages in the 21st century. Java, C and C++ are the most frequently used programming languages. [2].

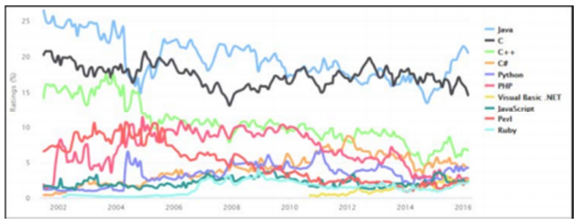

Figure 1 Most used programming languages in the 21st century [2]

According to the research of Job Postings (USA) (Figure 2) data related to demand for jobs and programmers are shown. It is a good index of any changes on the IT market during the last couple of years [3].

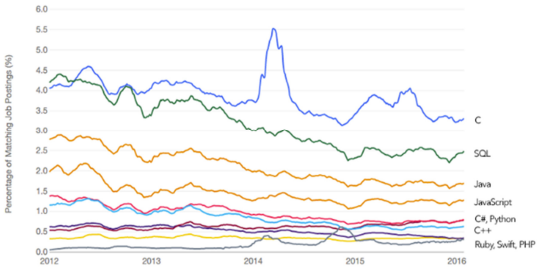

Figure 2 Demand for programmers' jobs during the last couple of years [3]

The research in the programming community StackOverflow that was published in February 2016 shows the most popular programming languages in use (Figure 3) [3].

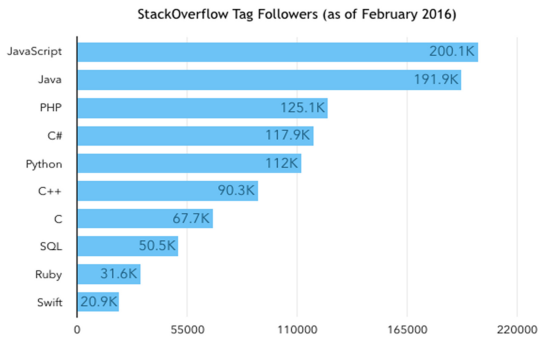

Figure 3The most popular programming language in February 2016 [3]

According to the Google Search Volume the future of programming languages mainly depends of the growth of the community that uses the certain programming language. Of course „fresh blood“ is always welcome for they will maintain the language popularity and ensure its use by new available resources. People are interested most in the programming languages as shown in Figure 4 [3].

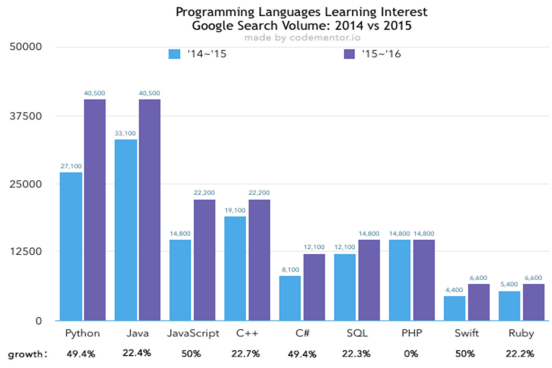

Figure 4 Programming languages that are most interested [3]

III. METHODOLOGY OF RESEARCH

The main problem of this research is the noticed problem that some schools use C# encirclement, while some The set problem is very actual and it is necessary to carry our this research.

On the base of the goals and assignment of the research the following hypothesis may be set:

In secondary vocational schools C# encirclement development is used more than in grammar schools.

The basis statistical group – sample were all students of 1st, 2nd, 3rd, and 4th years of secondary vocational school and grammar school as well as teacher from the territory of Vrsac on 10th January, 2017.

Students and teachers of the Secondary Vocational School „ Skolski centar Nikola Tesla“ and students and teachers of the Grammar School „Borislav Petrov Braca“ from Vrsac represent the research sample.

It is very clear the sample was chosen intentionally. We got the sample according to our opinion for we think that it is very important for the noted population.

IV. RESULTS OF THE RESEARCH

The teacher could choose one of the four offered answers C, b) C++, c) C#, d) other to the question related to which programming language did they use most frequently in grammar school.

Which programming language do you use most frequently in grammar school?

Chart 1 Which programming language do you use most frequently in grammar school

Comment: The illustrated data of the Chart 1 show that 50% teachers use C#, 25% use any other programming language.

The teacher could choose one of the four offered answers C, b) C++, c) C#, d) other to the question related to which programming language did they use most frequently in secondary school.

Which programming language do you use most frequently in secondary school?

Chart 2 Which programming language do you use in secondary school

Comment: The illustrated data of the Chart 2 show that 75% teachers of secondary school use C#, and 25% use C.

Answer to the question which programming language do you learn in school a) C, b) C++, c) C#, d) other.

If you study which programming language?

Chart 3 Which programming language do you study at school

Comment: Komentar: The illustrated data of Chart 3 show that 33.3% students study C, 33.3% study any other, 25% study C#, and 8,4% study C++.

Students could choose among the seven offered answers a) C#, b) PHP, c) Java, d) C, e) C++, f) any other, g) I do not study.

Chart 4 If you study, which programming language is it?

Comment: The illustrated data of the chart show that 33.3% of examined grammar school students do not study, 25# study PHP, 16.7% study C#, 8.3% study Java, 8.3% study C++, and 8.4% study any other programming language.

Answers to the question: Which programming language do you study at school? a) C, b) C++, c) C#, d) other.

Which programming language do you study at school?

Chart 5 Which programming language do you study at school?

Comment: The illustrated data of the chart show that 50% vocational secondary students study C#, 25% ustudy C, 16,7% study any other programming language, and 8,y3% study C++. If you study, which programming language it is?

Chart 6 If you study, which programming language it is

Comment: The illustrated data of the chart show that 25% of vocational secondary students study do not study, 23# study PHP, 25% study C#, 16.7 study C, and 8.3 study any other programming language.

V. CONCLUSION

Students and teachers of secondary vocational schools and grammar schools from Vrsac were the sample of the research that helped us to get the necessary conclusions. On the base of the collected data we conclude that 75% teacher and 50% students of secondary vocational school use C# encirclement development. As far as grammar school is concerned 25% teachers and 25% students use it.

After carrying out the research we can prove the set hypothesis: *In secondary vocational schools C# encirclement development is used more than in grammar schools.*

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Creating Games Using Java and Python

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Abstract – The basis of this project was to create game using mixed technologies. The programming languages that authors used to create this game was Java and Python. The core of the game can be represented with three modules that are explained in this project. This work covers fields of game mechanic, physics and coordinate system. Game was developed and tested in two different virtual environments and can be perceived as remake of the older game.

I. INTRODUCTION

Many people who worked or work in Android development say that it is never easy with Android and authors can confirm that, especially when is talked about game development in Android. Game was not developed in engines like Unity for example because authors wanted to make game from the scratch. The purpose of that was to learn how things work and to see how low level game development looks like and it was that educational part of the project. In order to create this game authors had to learn how physics work, how to draw things in Android coordinate system, how to calculate distance between objects, how collision works, etc.

A. About the game

Game that was made is based on and old classic game from Atari gaming platform called Missile Command. At first it was supposed to be a simple game but authors took it on the higher level and implemented their own vision of how the game should look.

II. RELATED WORK

Python supports multiple programming paradigms, including object-oriented, imperative and functional programming or procedural styles. It features a dynamic type system and automatic memory management and has a large and comprehensive standard library.

Programming education is widely recognized as important to a country, and research is being conducted on different approaches that may be necessary in different cultural contexts [1].

Python is becoming a popular programming language in teaching freshman programming courses. The easy syntax and feasible interactive mode made python ideal in both academic and industry applications. Combining Python with game programming is promising. [2].

Wang [2] was create the course and tried to combine the flexibility of python and the attraction of game design. Instead of printing strings, programming assignments were made more interesting by drawing shapes.

In the research about students' attitudes toward programming [3], in the pre-survey, 29% of the participants believed that everyone in the country should learn how to program a computer compared to 26% who did not while 45% remained neutral. By contrast, in the post-survey, the majority (54%) of the participants indicated that they agreed with the statement, 29% were neutral, and 16% disagreed.

A student's motivation is crucial in determining whether that student finds a particular resource helpful (Chen & Rada, 1996). Motivational factors might include:

- obtaining credentials toward a certificate or degree,
- securing jobs, and
- the potential for peer support.

III. TECHNOLOGIES

Game was developed with many technologies to solve and test different kind of problems. Main programming languages used for testing and game programming was Python and Java. Python was used for testing purposes. All algorithms and game logic was previously built in this language and later was transferred to Java. Main reason for using python was because of his executional speed. Also, it has great 2D game library that was used for drawing shapes and making collision detection algorithms. Android programming was done in Android Studio. Android Studio is the official IDE (Integrated development environment) for Android. It provides the fastest tools for building apps on every type of Android

devices. The bad side of using only Android Studio for developing a game is it's building time.

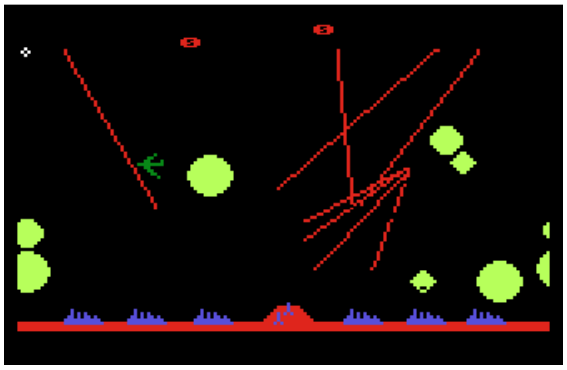

Figure 1: Missile Command Game

Process between debugging, building and testing were taking too long on this platform so in this part authors implemented python to reduce time between those processes. Project had two virtual environments. One was created with python and one was created by Android Studio itself. The environment created by the python was used in making and testing all sorts of algorithms used in game. After that if results were good game was ready to be rewritten in Java language so it can be compiled and used on the android mobile phone. It was not hard to rewrite all of it in Java language because the logic was the same. The idea was to compile game only once per new feature that was previously fully tested on python environment and authors were absolutely sure that new update will work on our android device. Separating those environments reduced our whole developing time.

A. Modules

The whole game can be separated in three minor modules that explain how game is really working:

- Draw
- Move
- Update

All the logic that run this game can be stored in those three concepts. The first one explains how things will be drawn on the screen. If all beautiful graphic from modern games were removed it will come to the part where they use primitive objects like circles and rectangles for collision calculations, moving etc. Second module which is related to moving part can be solved by combining coordinate system with primitive objects. Moving objects and checking if one object collide with another was main task that was solved in this module.

The last part that represent updating game is also needed because it keeps game alive. For example: calculating distance between two moving object if we calculate distance between two objects and we know that those objects are moving we should make sure that they will get new coordinates every time the game comes to update part. Refreshing the screen is the part of the update module and it will make sure that before draw screen is fully cleared.

IV. COLLISION DETECTION AND COORDINATE SYSTEM

A. Collision Detection

Next section will show how collision between circles are calculated: C1 with center (x1, y1) and radius r1; C2 with center (x2, y2) and radius r2; If the edges of the circles touch, the distance between the centers is

$$r_1 + r_2 \qquad (1)$$

Any greater distance and the circles don't touch or collide, and any less and then do collide. So, you can detect collision if:

$$(x_2 - x_1)^2 + (y_1 - y_2)^2 <= (r_1 - r_2)^2 \qquad (2)$$

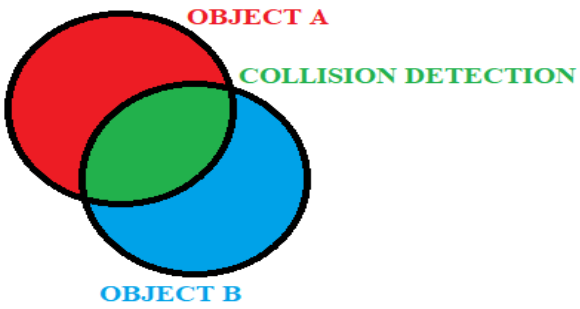

Figure 2: Collision detection between two objects

B. Coordinate System

Coordinate system in Android is a bit different than it were expected to be. It starts from top left corner and this spot is coordinate point with values (0,0). Top right coordinate point value is (MaxX, 0), MaxX is the width of screen. Bottom left coordinate point value is (0, MaxY), where MaxY is the height of the screen. Bottom right coordinate point value is (MaxX, MaxY). Note that MaxX and MaxY are dynamic values and they may be different for every phone because of phones display height and width.

V. OBJECT SCALING

Because of dynamic values of screen width and screen height there is a need to adapt game objects to have same size for every display. The most compatible way is to turn dimensions into percentage.

Figure 3: Android coordinate system

In this way screen width and screen height can be observed as 100% dimensions and objects are scaled by setting its width and height in percent's. For example: there is a phone with display size of 720x480 pixels, maximum width for a landscape mode is 720 pixels and it is 100% width and maximum height (100%) for a landscape mode is 480 pixels. If there is a need for a object that is size of 3 percent of display there can be used next equations:

$$width = MaxWidth * 3 / 100 \quad (3)$$

$$height = MaxHeight * 3 / 100 \quad (4)$$

This values need to be assigned to the object and this object will be same size on every display.

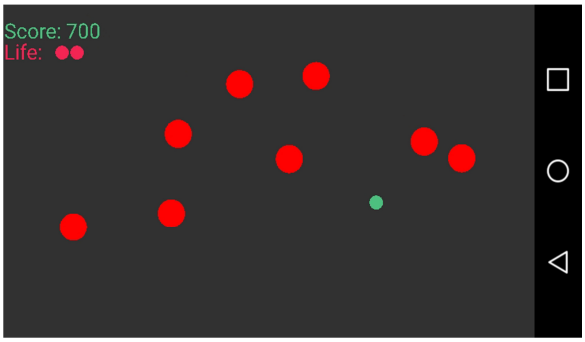

Figure 4: Scene from the game

VI. ANIMATION

One way of animating objects in Android is to make bitmap of object in every possible position and slice it inside of a program. This bitmap is called sprite. Sprite can be observed as a matrix and its size depends of complexity of an animation. If animation object has more directions, it will be more complex.

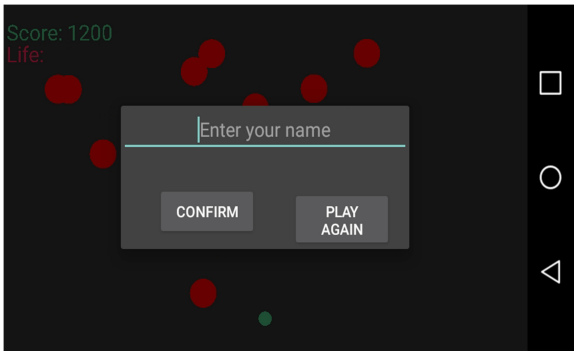

Figure 5: End game

Conclusion for this method is that every object position on a display have its own picture that is sliced from Sprite. One important fact for game animating and game development in general is threading. If threading is not used how it should be there will be a conflict with Android default UI thread causing application or game to crash or to freeze. To avoid that drawing objects needs to be done in separate thread.

VII.SCORE BOARD

Scoring in game is done just by summing specific value when objects collide. Scoring results are saved locally on devices hard drive memory with players username in JSON format at the end of the game and showing it in separated table when all lives in game are lost. This is not best practice because Google Play already have its own scoreboard for games and its integrated with Google Play Marketplace so there is no need for implementing scoreboard because there maybe can be conflict with Googles scoreboard. Knowing of that gives conclusion that score value that is achieved in the game needs to be passed to a Googles scoreboard.

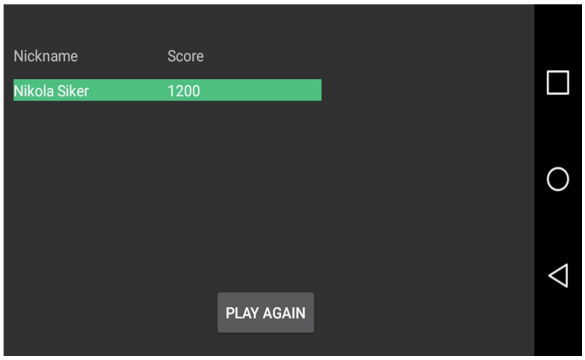

Figure 6: Score

VIII. CONCLUSION

Trough this project authors showed the posibilities of mobile game development and game development in general. Conclusion is that everybody who is into programming should try to make a game like this because this type of projects surely improves knowledge and skills and can shape perception of view while programming and also it can make someone to easier understand essential basic concepts of programming.

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