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Milan Pavlovic, Ph. D, Professor, Dean of the Technical faculty „Mihajlo Pupin", Zrenjanin

Technical treatment and design:
Ivan Tasic, Ph. D, Professor
Dijana Karuovic, Ph. D, Professor
Marjana Pardanjac, Ph. D, Assistant Professor
Erika Eleven, M.Sc, Assistant
Dusanka Milanov MSc, Assistant

Lecturer:
Erika Tobolka, Ph. D, Professor

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With this publication, the CD with all papers from the International Conference on Information Technology and Development of Education, ITRO 2015 is also published.

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INTRODUCTION

This Proceedings comprises papers from the **International conference on Information technology and development of education** that is held at TECHNICAL FACULTY ”MIHAJLO PUPIN”, ZRENJANIN, on June 26th 2015.

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

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

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

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

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

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

The Organizing Committee of the Conference

CONTENTS

THEORETICAL AND METHODOLOGICAL QUESTIONS OF CONTEMPORARY PEDAGOGY

CONCLUDING REMARKS ON THE DATABASE SYSTEMS SUBJECT FOR APPLIED INFORMATICS STUDY PROGRAM

Cs. Szabó, H. Telepovská, V. Szabóová
Technical University of Košice/Department of Computers and Informatics, Košice, Slovakia
Csaba.Szabo@tuke.sk, Henrieta.Telepovska@tuke.sk, Veronika.Szaboova@tuke.sk

Abstract - The Database Systems course was one of the key subjects of the Applied Informatics study program at our Faculty. By the termination of this specialization, we present our concluding remarks on this teaching subject. The main point of view for the evaluation presented in this paper is the evolution of the syllabus. We point out the changes in the teaching methods applied and teaching material used, and we express their impact on the subject schedule and students' results. As conclusion, we generalize our statements to build a set of recommendations usable for future improvements on different software engineering subjects.

I. Introduction

Teaching Information Technology subjects means endless facing of problems with integration of new approaches and research results into the subject's curriculum [2].

In the past eight years, we were members of the small group of teachers responsible for teaching different subjects for students of the Applied Informatics study program. This study program is outstanding in several properties compared to the other subjects at the Faculty of Electrical Engineering and Informatics at the Technical University of Košice (TUKE). It is different in the language used – English is preferred against Slovak. It is different by subject selection – subjects are not taught by members of a single department but the subjects cover three areas of information technology represented by three basic departments of the Faculty.

The Database Systems subject is situated in the study program schedule in the summer term of the second year. For those students who did not pass the exams in the regular year, the subject is open in the last (shortened) semester. The subject is popular between the ERASMUS+ exchange students as the lectures cover different areas of database design and theory and are organized by topics. Taking a subset of them only is suitable for short-term visits such as via the CEEPUS program too.

This paper is devoted to the findings achieved during the past years with the students of Database systems subject within the Applied Informatics study program. The number of the students was quite low – only a small group every year, but their contribution to the evolution of the study material and curricula is significant.

II. Our Incremental Curriculum Life-Cycle

A. Teachers

Teachers of the Database systems subjects are the authors of present article. The teaching experience was built on teaching courses on different types of database management systems such as Informix and Oracle [9] for different organizations – Technical University of Košice, T-Systems Company, University of Ss. Cyril and Methodius in Trnava.

Visiting professors usually teach one week – if they choose this subject, it means a new lecture topic.

B. Students

There were four categories of students at the subject, where these categories are defined by the way the students came to the subject:

- Regular students. These students enrolled regularly at the subject as they had it chosen from the study program's list of facultative subjects. This category is typical, only a subset of the students really uses the achieved knowledge in further studies or future life.
- Students with individual study plan. These students are usually foreign students who can decide about the content of their study plan during a negotiation period. After finishing the subject, these students usually apply the achieved knowledge in further studies, in their diploma theses.

Deň	HODINY				
	06:00 - 07:30	12:30 - 13:15	13:15 - 14:00	14:15 - 15:00	15:00 - 15:45
Pondelok					
Utorok					
Streda					
Štvrtok		Databázové systémy DBS L9-B_510 Ing. Csaba Szabó, PhD. P AI		Databázové systémy DBS L9-B_515 Ing. Csaba Szabó, PhD. CL AI	

Figure 1. Database Systems schedule for ST 2014/2015 (P – lecture, CL – lab)

- ERASMUS exchange students. These students select and negotiate their study plan one semester in advance, but there do not apply the requirements (e.g. prerequisites) for regular students. These students present their motivation for selecting the subject variously – they usually need to refine their knowledge in this specific field.
- CEEPUS exchange students. This category of students visits our Department for a short term (e.g. one month). These students join the group of other students for four weeks, they benefit from the teaching material if they need to prepare something for a specific subject at their home university.

C. *Lectures*

We follow the logic that a lecture should be always before the lab, but it already happened to our subject that the generated schedule did not meet this criterion perfectly. In past years, lectures and labs even were scheduled for two different days, but since the last year, the schedule got fixed for Thursdays. Fig. 1 presents the schedule for the current year.

The contents of the lectures developed during the years. The most important change to introduce was the one dealing with the variety of the students' knowledge – to provide a material useful to all of them and to allow attendance at selected topics only. This means that we had to prepare as complex lectures as possible, which we hope we did. Unfortunately, there are topics that require knowledge of other topics, and topics that we had to split across two lectures (these are larger than to be presented in 90 minutes). The next problem we had to face was the level of students' skills. We solved this problem by decreasing the requirements on programming skills and by increasing the requirements on database design skills. (The same we applied in the case of the labs and exams.)

Fig. 2 shows the details. The content of this figure denotes one increment of our curricula with the changes provided based on the above-mentioned structural requirements.

D. *Labs*

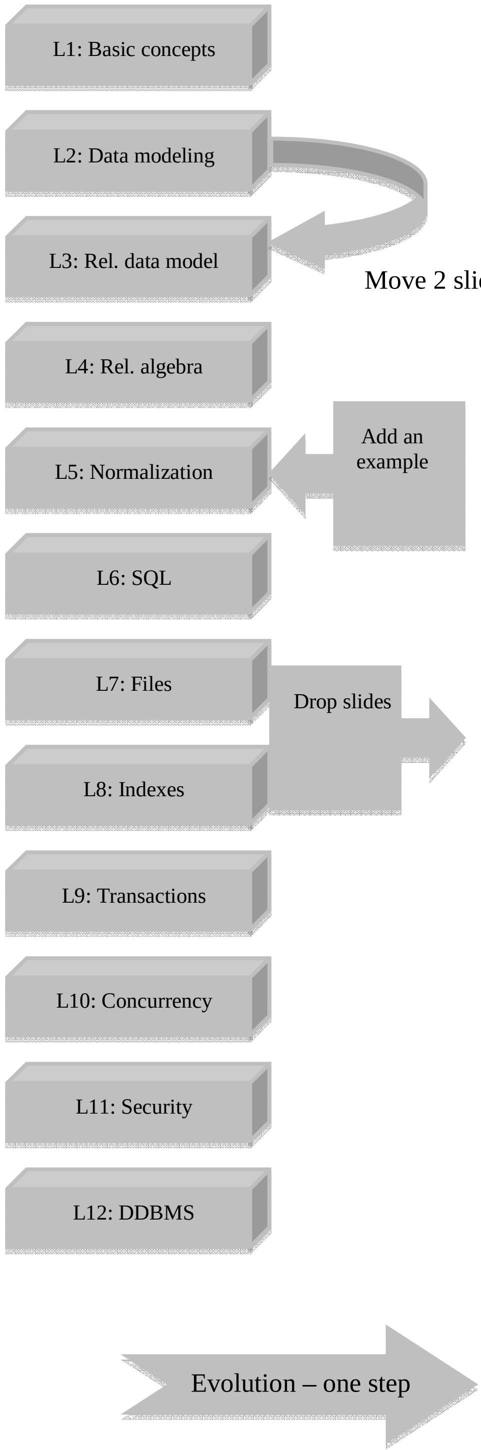

Figure 2. Database Systems lecture evolution

AI - lessons Iba súhrnné známky

Zadanie (2.2) Essay upload Trieďiť zostupne	Zadanie (2.2) Project upload Trieďiť zostupne	Manuálna položka Activity Trieďiť zostupne	Test Test AI Trieďiť zostupne	Súhrnná známka Kategória spolu Trieďiť zostupne
12,00 Grade analysis	7,00 Grade analysis	2,00	- Grade analysis	**21,00**
12,00 Grade analysis	7,00 Grade analysis	2,00	- Grade analysis	**21,00**
12,00 Grade analysis	11,00 Grade analysis	4,00	- Grade analysis	**27,00**
12,00 Grade analysis	7,00 Grade analysis	1,00	- Grade analysis	**20,00**
12,00	**8,00**	**2,25**	-	**22,25**

Figure 3. Database Systems labs grading detail

To maintain diversity, we decided to minimize the interconnection between the material taught at the lectures and the practical examples presented and analyzed at the labs.

Initially, we focused on various aspects of SQL using the dialect implemented in Oracle 11g, even selected parts of PL/SQL were practiced. Later, we decided to remove topics related to triggers and stored procedures from the labs' material. Our decision was based on the experience that this is a somewhat different and more advanced topic than we could expect from a subject dealing with database systems' basics. The actual content of the lab material focuses purely on SQL and closely related topics, such as DDL (data definition language), DML (data manipulation language), DCL (data access control language), TCL (transaction control language) and RA (relational algebra [8,11]). RA is related closely to the lectures from the above list only. This change also influenced the tasks for the students.

The basic idea of the database systems task was to design a database schema for a specific purpose and to develop a CRUD application (client-server architecture). This pattern for the tasks was modified during the past years to gain its actual form:

The students have to design a database schema from scratch – they begin with a set of data. This schema has to be transformed into (at least) 3NF (3rd normal form) [3], and then filled with the original data. It is required to hand in the database scripts including all DDL, DML, DCL and TCL statements used by the student. This step could be implemented in a different way too, but there was no student applying database refactoring [4] until now. The schema has to fulfill additional requirement such as extended integrity criteria or usage of sequences. The second part of the task is to write equations of relational algebra for specific purposes defined in the body of the task definition, which RA equations have to be then transformed into SQL SELECT statement and compiled as VIEWs into the database.

In addition to the above-described task, the students have to write an essay on selected topic of database systems such as Armstrong's axioms, different data models or federated databases. The purpose of these essays is to teach students additional details on selected topics that are not covered by the lectures. This section also opens the horizon for actualization in specific fields – involving students into the development of the lectures and other course material.

At labs, we also evaluate student activity. The conclusion of lab activity evaluation is shown in Fig. 3 of our electronic supporting system. The limits for success at the labs are 16 points at minimum and 30 points at maximum.

E. Exams

Since we have developed a very nice electronic system [7] that supports our activities, we rely on it also in the case of the exams. Partially. The reason is that during the past years of using electronic systems for examination we found out that the students forgot to "speak". Our experience shows that the majority of the students are unable to talk continuously about a selected topic – even a sequence of five sentences is a problem sometimes. We decided to change this as well, therefore we returned to the system of exams from the times before the electronic supporting systems', and we combined these two approaches as follows:

- The electronic system is used for the electronic test [1], which is the first part of the exam. It weight is 50 of 70, i.e. the students can achieve at max. 50 points from the electronic test, while the maximum points for the exam is 70 in total.
- The second part of the exam is verbal, where the student has to answer two questions. This part is mandatory; the student cannot say she/he is satisfied with the score from the test alone – not attending the second part implies failing the exam. The main topic area of the question is selected randomly; the discussion then covers a specific part of the topic area. Weight of the verbal part of the exam is 20 of 70.

We started with optional verbal part of the exam, but our students did not attend it, which was then reflected in the average results. This is not a good strategy at all, because sometimes the verbal part is more successful.

Termíny, ktoré sa ešte nekonali					
Dátum a čas	Miestnosť	Predmet štúdia	Popiska	Stav	
14.05.2015 12:00	L9-B_510	Databázové systémy	Exam	6 / 18	
21.05.2015 08:00	L9-B_510	Databázové systémy	Exam	0 / 18	
28.05.2015 08:00	L9-B_510	Databázové systémy	Exam	0 / 18	

Figure 4. Database Systems exams' detail

F. *Electronic supporting systems*

The roots of our electronic supporting systems are the modular academic information system used at TUKE and LMS Moodle at our department. As we need to communicate with the students, we also use university e-mails (students have to use the assigned mailbox).

The incremental property of the evolution is related to improvements in the question base in LMS Moodle in three different aspects:

- Updating the question content [5]
- Adding new question types [6, 10]
- Updating previously added question types

All above-mentioned actions are performed even immediately based on the situation.

Using the university information system, we get the list of students registered for the subject, for schedule, and for the exams; we can also make evidence on attendance at lectures, labs and exams and we can use this system for grading of lab activity and exam results (a small example is shown in Fig.4).

G. *Evaluation criteria for starting a new iteration of the incremental life-cycle*

This subsection presents the most important part of the article, the criteria used to start a new iteration of the curricula and teaching material development. We had several of them as listed below:

1. Which were the easiest lecture topics?
2. Which ware the hardest lecture topics?
3. Which essay topic is suitable to be included with the lectures?
4. Which were the most problematic labs?
5. Which were the easiest labs?
6. Are there errors or ambiguities in the questions?

The evaluation of the above criteria was always performed in relation to the count and results of the students, e.g. if a single student claims a problem with a specific topic only, then this is not a real stimulus for an iteration. Data collection was always realized immediately the student finished the first exam (exam results were not taken into consideration).

For Item 1 and 2, we asked each student to select exactly three topics of a kind. The student also had to define his own order of his selection. If there was a match on topics in between at least 20% of the students, we analyzed and refined the content of such lectures.

With Item 3, we asked the students at the labs. Only a match above 50% was considered as worthy for further processing. Mostly adding several new slides to existing lectures – not by replacing any of the original slides, made improvements.

Answers related to Items 4 and 5 were handled similarly as those for Items 1 and 2. Changing the labs was implemented by adding/removing/changing examples and tasks; or by changing an example to a task or vice versa.

Item 6 was more specific, because these kinds of errors were detected during using the system – some of them were reported at exams or in-semester-tests. Improvements in specific questions could be usually implemented in the moment of the identification of the source of the problem; others started a real development cycle such as in the case of execution failures of new question types.

The most important outcomes of involving the students were that they also suggested the way of improvement and (in several cases) the students themselves wanted to implement these improvements in the form of Bachelors' theses.

III. CONLUSION

The Applied Informatics study program at the Faculty of Electrical Engineering and Informatics at the Technical University of Kosice can be evaluated as a successful study program. The Informatics related subjects do not build a complete unit at all, but the Database systems subject acts in a sovereign way.

The past years of curricula development, of endless improvement of the question banks and development of supporting tools led to something we can be proud of. Unfortunately, the new accreditation does not include this subject as there was the Applied Informatics program removed from the accreditation.

The English version of the lectures, labs, tasks, question bank and other course material will be now less developed – mainly only based on the requirements of the several CEEPUS and ERASMUS+ students who enroll this subject in the future.

We would recommend involving students into the development of the new learning material as the students know the best how they would like to learn. In addition, how they might be able to gain the maximum from the study material. It does not mean that we should completely rely on the students' results such as essays, but these could be used to evaluate several possible directions in curriculum development. Asking the students using an anonymous questionnaire about the easiest and hardest topics presented serves with the most objective answers to the question "is it enough, or is it too much?"

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SEVERAL ASPECTS OF MEASURING PERFORMANCE OF UNIVERSITY STUDY CYCLES USING DEA

R. Timovski[*], T. Atanasova-Pacemska[**], A. Rusiti[***] V. Sarac[****]
[*]Head of E-Index department, Goce Delcev University in Stip, Republic of Macedonia
[**]Faculty of Computer Sciences, Goce Delcev University in Stip, Republic of Macedonia
[***]Pedagogical Faculty St. Kliment Ohridski, Ss. Cyril and Methodius University in Skopje, Republic of Macedonia
[****]Faculty of Electrical Engineering, Goce Delcev University in Stip, Republic of Macedonia
riste.timovski@ugd.edu.mk, tatjana.pacemska@ugd.edu.mk, agim_rushiti@yahoo.com, vasilija.sarac@ugd.edu.mk

Abstract - Higher education presents main engine of society's overall progress and development. In this context, Universities are meant to be generators of knowledge and academic force, which can be treated as output of their functioning. It is important to achieve high level of educated and qualified students/future employees that will be able to fit in the real sector and contribute to the collective/personal live. On the other side, it is necessary to invest some specific resources in order of efficient productivity of knowledge – input in the process. Having this in mind, we can always learn from the past, in meaning what is invested as input and what is the result, as output. This paper treats different study programs / cycles at a specific University as entities, that use specific kind of resources as input and produce knowledge as output. Linear programming technique application called DEA (Data Envelopment Analysis) is applied, in order to show several aspects of efficiency measurement of the study cycles and their comparison.

I. INTRODUCTION

Optimization in mathematical terms usually means how to find the best of the offered / possible alternatives to solve a speciffic problem or give answer to the question which option is the most efficient, among all of the options available. In terms of linear programming (LP), the approach means that it is necessary to build a precise mathematical model that reflects the real problem in a best way, so that it is possible to project the process being observed as a production function of the system. In this manner, the "mathematical" goal is to find the minimum / maximum (dependds on the approach) value of that production function. The LP modeling of the system means to sketch the real problem as an input/output system. The inputs and outputs represent real values (variables) with their own characteristics and limitations and are used to mathematically sketch the objective function, which is actually the subject of optimization (optimization of linear equitation). The objective function should give real picture of the interdependence of the parameters of the system. 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.

A. DEA mathematics

In order of correct application of DEA, modeling of the real world should include:

- Set of production units – entities from the real world that will use specific set of input parameters to produce specific set of output parameters – known as DMUs (Decision Making Units);
- Input parameters (same for all DMUs);
- Output parameters (same for all DMUs);
- Technical efficiency (the goal of the examination) of a single DMU is defined as:

$$\theta = \frac{Output}{Input}$$

We call it ***Pareto*** efficiency in case of best allocation of the resources (usually inputs) in the observed set of DMUs. The DMU with Pareto efficiency is an efficient DMU. The other DMUs are relatively inefficient (only in the observed set of DMUs). It is impossible in the case of efficient

DMUs (and the observed set of DMUs) to change something and thus to achieve better performances to the efficient DMUs (it is impossible to improve the output without worsening the input).

With n DMUs, m inputs and s outputs, 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 $x_{1k}, x_{2k}, \dots, x_{mk}$ are the inputs of the k-th DMU, $y_{1k}, y_{2k}, \dots, y_{sk}$ are the outputs of the k-th DMU, $v_1, v_2, \dots, v_m$ are inputs' weight coefficients and $u_1, u_2, \dots, u_s$ are outputs' weight coefficients, with mathematical limitation (in connotation of the reality):

$$v_1, \dots, v_m \geq 0, u_1, \dots, u_s \geq 0,$$

In this paper, we use DEA CCR CRS input oriented model [1]:

- 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:

$$\frac{u_1 y_{11} + u_2 y_{21} + \cdots + u_s y_{s1}}{v_1 x_{11} + v_2 x_{21} + \cdots + v_m x_{m1}} = \frac{\sum_{i=1}^{s} u_i y_{i1}}{\sum_{j=1}^{m} v_j x_{j1}} \leq 1$$

...

$$\frac{u_1 y_{1k} + u_2 y_{2k} + \cdots + u_s y_{sk}}{v_1 x_{1k} + v_2 x_{2k} + \cdots + v_m x_{mk}} = \frac{\sum_{i=1}^{s} u_i y_{ik}}{\sum_{j=1}^{m} v_j x_{jk}} \leq 1$$

...

$$\frac{u_1 y_{1n} + u_2 y_{2n} + \cdots + u_s y_{sn}}{v_1 x_{1n} + v_2 x_{2n} + \cdots + v_m x_{mn}} = \frac{\sum_{i=1}^{s} u_i y_{in}}{\sum_{j=1}^{m} v_j x_{jn}} \leq 1$$

$$v_1, \dots, v_m \geq 0, u_1, \dots, u_s \geq 0;$$

$$x_{ij} \geq 0, y_{rj} \geq 0; i = 1, \dots, m; r = 1, \dots, s; j = 1, \dots, n.$$

The result are weights that maximizes each DMU's efficiency in correlation of all 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. It is represented with following equations:

- Find $min\theta$
- Having limitations:

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{i0}, \qquad i = 1, \dots, m$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0}, \qquad r = 1, \dots, s$$

$$\lambda_j \geq 0, \qquad j = 1, \dots, n$$

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. The composite DMU for each inefficient real DMU is consisted as sum of the ERS (efficiency reference set – efficient DMUs used for interpretation of the composite DMU for the observed real DMU) multiplied with its lambda coefficients. As an example, 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' is given with:

$$\lambda_A \begin{bmatrix} y_{1A} \\ \cdots \\ y_{sA} \\ x_{1A} \\ \cdots \\ x_{mA} \end{bmatrix} + \lambda_B \begin{bmatrix} y_{1B} \\ \cdots \\ y_{sB} \\ x_{1B} \\ \cdots \\ x_{mB} \end{bmatrix} = \begin{bmatrix} y_{Composite} \\ \cdots \\ y_{Composite} \\ x_{Composite} \\ \cdots \\ x_{Composite} \end{bmatrix}$$

In DEA world, we speak about "good enough" solution and real enough models [2].

II. Problem, Goal and Modeling

It is very difficult to measure the quality of the educational processes, especially in terms of high education. In order to be able to give assessment of a specific process in high education / whether it is efficient or not, there are numerous factors that need to be considered and also, their mutual links, dependencies and correlations. The approach that is used in this paper (and furthermore as base of the model that DEA is applied on) is based on following:

- Study cycles, in terms of study course + generation of students is the main producer of knowledge (Data ;
- Resources are invested in each study cycle (input parameters);
- Each study cycle produce specific categories of knowledge (output parameters), and
- How to structure this data in a DEA model, in order to find the best study cycle.

Details for the approach:

- Consider the inputs as parameters whose increase will reduce the DMU's efficiency, and

- Consider the output of parameters whose increase will increase the DMU's efficiency.
- Each study cycle (course + generation) delivers skills and knowledge structured and provided in the study programs accreditation documents. They form the output set. For this goal are used specific resources in terms of finances and other (usually) material issues. They form the input set. For building more than one model, bigger set of input and output parameters are gathered and used (DEA applied) in specific combinations. Having this, the model can be pictured as:

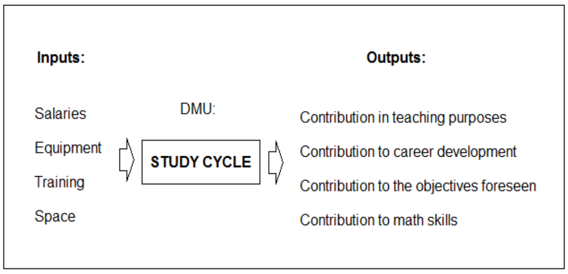

Figure 1. Study cycle DMU DEA model

A. *Input and output parameters*

Input parameters are:

- Expenses of the University for hiring teachers (professors and assistants) during the regular study cycle (three study years for each study cycle). Expenses are calculated as gross salaries. The factor of load / utilization in terms of teaching on more parallel study years from different study cycles is taken into account;
- Expenses of the University for the equipment (computers, projectors etc.) for the specific study cycle. The degree of utilization, i.e. the ratio of annual depreciation of computer equipment and inventory used is taken into account, as well as the percentage of load / utilization in terms of number of students of the observed course and all students that used the same equipment (parallel study years from different study cycles);
- Space used for each study cycles realization, in terms of square meters. Load / utilization factor is taken into account also, and
- Expenses of the University for realization of employed professors and assistants trainings, conferences and every activity for their professional improvement, in the country and abroad.

Output parameters are (strictly defined in accreditation documents of the study programs, in terms of average indexes from 1 to 5):

- Contribution in teaching purposes;
- Contribution to career development;
- Contribution to the objectives foreseen, and
- Contribution to math skills.

B. *Model tables*

For displaying several aspects of measuring efficiency and performance of the study cycles, DEA was applied to these three derived models from the general table (2 inputs and 1 output each):

TABLE I. NUMERICAL DEA MODEL 1

DMUs	Teachers expenses (EUR)	Space (squared meters)	DMUs explicit	Contribution to career develop.
DMU1	124.080	180	Generation 2008-2011, Business informatics	3,5
DMU2	124.080	90	Generation 2009-2012, Business informatics	4,5
DMU3	112.800	180	Generation 2010-2013, Business informatics	3,75
DMU4	319.200	640	Generation 2006-2009, Computer sciences	4
DMU5	324.900	640	Generation 2007-2010, Computer sciences	3,5
DMU6	285.000	640	Generation 2008-2011, Computer sciences	4
DMU7	285.000	640	Generation 2009-2012, Computer sciences	3,33
DMU8	250.800	640	Generation 2010-2013, Computer sciences	4,33
DMU9	50.160	90	Generation 2009-2011, ICT-Computer engineering	4

TABLE II. NUMERICAL DEA MODEL 2

DMUs	Teachers and training expenses (EUR)	Equipment expenses (EUR)	DMUs explicit	Contribution to math skills
DMU1	124.080	0	Generation 2008-2011, Business informatics	4,33
DMU2	124.080	0	Generation 2009-2012, Business informatics	4,8
DMU3	112.800	0	Generation 2010-2013, Business	4,75

			informatics	
DMU4	330.966,67	106.366,67	Generation 2006-2009, Computer sciences	3,13
DMU5	336.366,67	67.366,67	Generation 2007-2010, Computer sciences	2
DMU6	297.326,67	52.354,67	Generation 2008-2011, Computer sciences	4,5
DMU7	298.410,00	34.248	Generation 2009-2012, Computer sciences	3,33
DMU8	265.843,33	21.128	Generation 2010-2013, Computer sciences	3,33
DMU9	50.160	3.000	Generation 2009-2011, ICT-Computer engineering	2,75

TABLE III. CUMULATIVE NUMERICAL DEA MODEL

DMUs	All expenses (EUR)	Space (Squared meters)	DMUs explicit	Cumulative con. index
DMU1	124080	180	Generation 2008-2011, Business informatics	4.04
DMU2	124080	90	Generation 2009-2012, Business informatics	4.225
DMU3	112800	180	Generation 2010-2013, Business informatics	4.0625
DMU4	437333	640	Generation 2006-2009, Computer sciences	3.6425
DMU5	403733	640	Generation 2007-2010, Computer sciences	3.125
DMU6	349681	640	Generation 2008-2011, Computer sciences	3.875
DMU7	332658	640	Generation 2009-2012, Computer sciences	3.5825
DMU8	286971	640	Generation 2010-2013, Computer sciences	4.08
DMU9	53160	90	Generation 2009-2011, ICT-Computer engineering	3.875

The first two models have taken specific aspects of the impact of the financial resources and square on concrete outputs and offers possibility to measure the efficiency in such an enviroment. The third model integrates all input and output parameters. The output parameter takes into account all real output parameters as equally signifficant and represents the average value for each study cycle.

III. RESULTS, DISCUSSION

The three models from the same environment are processed with specific software solution to generate the clear picture of efficient and inefficient production units (three pictures).

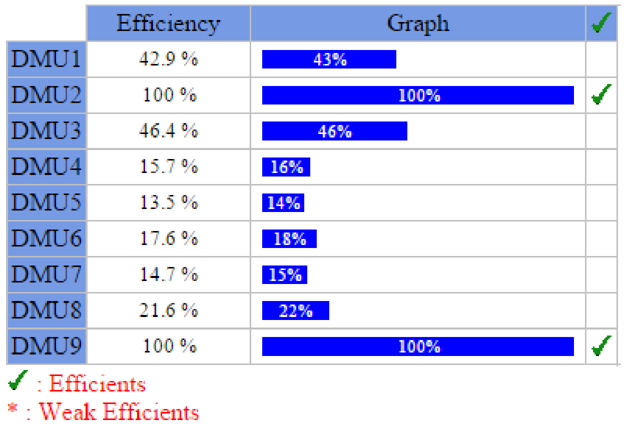

Figure 2. Efficiency graph DEA model 1

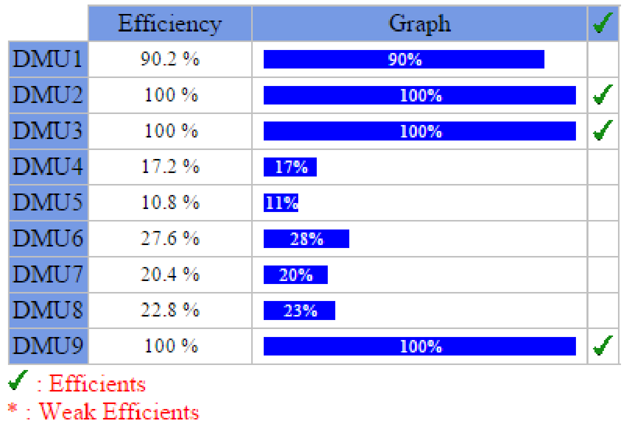

Figure 3. Efficiency graph DEA model 2

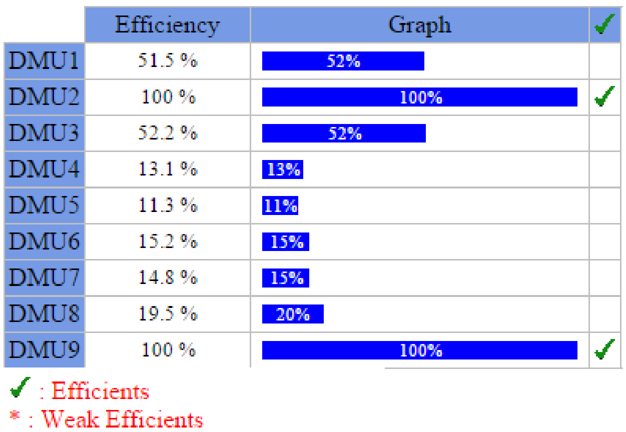

Figure 4. Efficiency graph DEA model 2 (All parameters included)

Study cycles with efficiency = 1 (100%) are noted as relatively efficient and represent the set of ERS cycles for the cycles with efficiency bellow 1, noted as inefficient cycles. Most efficient cycles are used in most of the cases of composite cycles. Looking in figure 2, 3 and 4, it easily can be noted that DMU 5 is the most inefficient DMU in all cases, even in the case of All Integrated DEA model (Figure 4). This study cycle consumed enormous resources to produce worst results (in terms of educated students / students with worst results) in the observed set. From the other side, DMU2 and DMU9 are noted as efficient study cycles with best input resource allocation and should be example (ERS) for all the other DMUs, noted as inefficient.

Because the cumulative DEA model (figure 4) integrates all the input and output parameters, it can be noted as most important model that gives clear picture where to make an intervention in order to improve the study cycle in general. Figure 5 shows ERS set and frequency of their use, building the composite units for inefficient DMUs:

	Peer Group	Frequencies	✓
DMU1	DMU2,DMU9	0	
DMU2	DMU2	5	✓
DMU3	DMU2,DMU9	0	
DMU4	DMU2,DMU9	0	
DMU5	DMU2,DMU9	0	
DMU6	DMU9	0	
DMU7	DMU9	0	
DMU8	DMU9	0	
DMU9	DMU9	8	✓

✓ : Referenced

Figure 5. ERS set for cumulative DEA model

Figure 6 gives the information about the composite units for each inefficient study cycle. DEA propagates that, in order to make inefficient DMUs efficient, changes have to be made that will cause for each inefficient course to became as closer it is possible as its composite DMU / study cycle, that lays on the frontier (set of best possible courses, virtual or real). For constant output, every composite entity is consisted as sum of the multiplications of **lambdas** and inputs of the ERS entities, qualified as efficient.

	DMU2	DMU9
DMU1	0.129	0.902
DMU2	1	0
DMU3	0.048	0.996
DMU4	0.109	0.821
DMU5	0.041	0.762
DMU6	0	1
DMU7	0	0.925
DMU8	0	1.053
DMU9	0	1

Figure 6. ERS set for cumulative DEA model

Figure 7 shows probably the most important ratio diagram – Expenses / Efficiency:

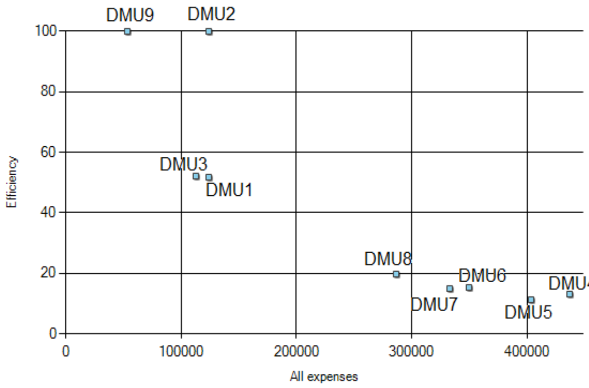

Figure 7. Efficiency / Expenses ratio

IV. Conclusion, Possible Optimisations

This paper makes one clear approach of measuring the study cycle efficiency in high education. We applied DEA on a set of 9 study cycles, with respect to the 4 inputs and 4 outputs. In the first two aspects are taken certain parameters (several of them) to build a specific image of mutual dependence on each other. In the third embodiment, all parameters are included to generate the all picture. In all the cases, the dependence of each input resource can easily be noted. It is understandable that the reduction of each can improve the specific study cycle. Using this results and the information that is specific for each study cycle (which professors and assistants were engaged, their professional experience, the types of trainings conducted, the effects of them etc.) can be a good guideline for improvement steps taken from the management of the institution. The model that is used (input oriented CCR CRS) allows intervention at the input side, for bigger efficiency [3]:

- Reduction of expenses for professors, assistants and associate staff:
  - o By engagement of the teachers and assistants for bigger number of students (increase the effectiveness);
  - o By reducing the amount of gross financial structure / salaries;
  - o By realizing training and additional activities for lower prices.
- Reduce costs for equipment:
  - o Purchase cheaper equipment;
  - o Usage of the same equipment by bugger number of students.
- Better use of the space:
  - o Use smaller rooms;

- Use same rooms for bigger number of students.

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SOCIAL AND FAMILY CIRCUMSTANCES AND THE SUCCESS OF PUPILS

A. Terek
University of Novi Sad, Technical Faculty "Mihajlo Pupin" in Zrenjanin, Republic of Serbia
angiterek91@gmail.com

Abstract - The main aim of this research is to examine pupils who attend elementary school higher grades, how much do social and family circumstances influence their success in school. Many different factors have influence on pupil's school success. Because of these reasons it was necessary to examine do pupils possess basic educational materials needed for learning, does the educational attainment of their parents influences their school success and in what way punishing and praising children could affect their success in school.

I. Introduction

Family, as the primary factor of socialisation determines the total development of the child so partly determines his school success too. The results of previous researches clearly show that there is a connection between family circumstances and pupil's success in school [6].

With the support of their parents every child feels more safely and his self-confidence grows. That support doesn't mean just helping them solving tasks, monitoring their work and success in school, but providing them the necessary educational materials so they can progress in school. Punishing and praising children is also an important factor of school success, but just if parents use them properly. Many researches have shown that socio-demographic charasteristics of the family , like socioeconomic status, family structure, divorces, the characteristics of the mother, the size of the family, neighborhood characteristics are related with the academic success of pupils (Barry, 2005.; Bilič,2001.; Čudina-Obradović and Obradović, 1995.; Magdol, 1991.; Rečić,2003.; White,1982.) [6].

II. Social-Family Circumstances

There is no precise definition of what success or failure is, and the cause of this is the imprecision in formulating the curriculum and the determination of some elements of teaching. There are still no confident methods and procedures by which we could identify the school success or failure. The continuity of school success determines as the relative stability of school marks that a pupil achieves during his schooling. For pupils who consistently achieve good success it is believed that they have continual school success, but if during their schooling their success changes, they have discontinual success [7].

Success in teaching - "expression of achieved material (informative, cognitive), functional (formal, psychomotorical, operational) and educational tasks, quality and quantity of acquired knowledge". The success in education can be presented numerical (from 1 to 5 in elementary school and from 5 to 10 in college), , alphanumerical (A, B, C) and descriptive [7].

A. *Modern family*

Definition of family - "Family is a group for what each individual feels a need, because the aims it achieves aren't specialised, they are more fundamental and more generally, and because of this, it is the most universal group in the whole world, it is unique in that it is important for each person's – for his entire life [6].

Family and family climate are from priceless signifikance on school success. The developement of child's personality, his interests, achievements, success and failure come from his family and family conditions. Educational status of the parents has also influence on pupil's success. Pupils are often trying to identify themselves with their parents in most activities, as in their educational achievements too. Pupils who achieve good results in adopting the teaching content, in most cases come from families with high educational level, and high economic status. Family structure also has a great influence on pupil's success. Every family is an institucion for itself, and the differences in relation with other families can be related with: complete and incomplete family, the number of children in the family, gender of the children... Pupils who come from complete families have better achievements in school, unlike pupil who come from incomplete families. This doesn't mean that these children are less inteligent, but they can have a different status in the class and other pupil often treat them on a different way. Will it between pupils develop a feeling of acceptance or rejection it depends on how the child accepts the fact that he will be cared of one parent or someone else. This fact and the number of children also reflect his success and achievement in education [7].

B. The influence of socieconomic status on pupil's success

The causes of failure in school are numerous, the educational achievement of pupils is a result of many factors, and it is doubtless that poorness is an important pointer of need to change the position of vulnerable children in frames of institucional education. Comparing the school success of children who come from poor layers and those who come from rich families within different countries and on international plan shows that poor children have worse achievements and much more problems in school [1].

The economical power of the family influences the buying of educational materials, travelling insurances, excursions, courses and similar forms of additional teaching, which then influences the cognitive development of the child and his performances . Conger and contributors (2002.) through the model of family stress are underlying that the economical difficulties and the parental perception of economic difficulties influences the emotional difficulties of parents and their conflicts, which changes their style and relation (in terms of decreasing their love, and incresing rigor according to the child). A »situation« like this in the family leads to children's emocional difficulties and problematical behaviour, and at the end to lower school success [6].

However, bad socioeconomical status of the family doesn't always have to have negative influence on pupil's success. Every person is unique on his way, and because of this no one experiences positive and negative things on the same way. While the lack of ma terial resources will bring someone indisposition, lower level of motivation , bad grades, others will be motivated, and find solace in books and studying in hope that one day they will rise from poverty and provide better living conditions to their familiy.

C. The influence of praising and punishing on pupil's success

The analysis of hierarchical theory of motivation by Maslow (Maslow, 1982) provides insight into the priority of satisfying the needs. It suggests that basical needs dominate over other motives. When the general physiological needs for safety are satisfied, then the motives for love with self-esteem and self-actualisation become important. Applycying these facts on children's development and achievement, we clearly see that they will develop for knowledge, just in case their needs for care and attention are met. On the other hand, school success can contribute the development of other needs, like the need to belong somewhere, need for love and self-esteem [2].

However, development and advancement of the child requires an adequate measure of love and support. Praising and rewards stimulate the success of the child just in case they are proper. Too much praising focused on some personality dimension of the child, for example, intelligence, may direct the experience of success wrong, and it can reduce some desirable forms of behavior, like commitment and effort. If it is pointed out and encourages the invested effort, activity and engagement of the child, this creates a prerequisite for developing motivation for advancement [2].

Teachers are conscious that it is necessary to refer encouragement or praise to pupils , so they could achieve better results in studying, but on the other hand, they expect from pupils to behave properly. Researches show that rewarding behaviours and activities of students related to studying and achieving success are more present compared to rewarding social behaviours of pupils (Merrett & Wheldall, 1993) [3].

Punishments are taken with a predetermined intention, so the general and final aim of punishment application in school is the attempt to change the pupil's behaviour, so he could take part in school life on a more successfully way. (Duke, 1990;Gašić-Pavišić, 1988; Parke, 1977). This educational process, from one side has a preventive, and from the other side a corrective function. For some children it is enough a mild warning or a conversation, while others must be treated more severe.While punishing the child, it is preferably to find out the real motives of undesirable behaviour and on that basis decide what the punishment should be. (Lalić, 2003). Regardless of the individual charasteristics of the pupils, punishment should never be delayed and it should be logically related with the punished procedure [3].

D. The impact of cooperation between schools and families on student's success

There are many reasons for cooperation between schools and families. The most important are:

1. A child, or student most of his time spends in school and in family. In school he spends six, seven or more hours daily, especially if it is included in the extended stay at school. If it is viewed generatinally , a child spends eight, twelve or more years in school, depending on the duration of the school. As for family, much more time. Because of these reasons it is believed that family and school are the most important factors of education and that the cooperation between these two factors are natural.
2. The cooperation between family and school is a statutory obligation (defined in terms of the obligation of parents to participate in advisory and administrative bodies of the school, in planning and programming, in executing school activities, mutual information, deciding and similar).
3. Family needs the help of school and society so it could carry out it's educational role. Especially when it comes to prepare the child for school starting, adaptation of the child in the school environment, mainstreaming the requirements and expectations, joined and harmonized appearance before the child, helping family to carry out the obligation of a school child, in terms of professional orientation, forming a system of values, socialisation of the child and other delicate questions.
4. Some organizational aspects of educational work without school and family it is not even possible to carry out. For example, school in nature, extended stay in school, school trips, school socially useful work or leisure activities, celebrations, lectures, etc.
5. Without cooperation it is impossible to solve some serious questions related with addictive diseases, help for children with special needs, the development of gifted children, professional guidance, disturbed family relationships...
6. Many program activities of school's pedagogical-psychological services are related to participation and cooperation of the parents , so it is impossible to achieve those activities without them [5].

E. The impact of social-family circumstances on pupil's school success in the world and region

The results of some researches in our environment (Piorkowska-Petrović, 1990) show that despite the relatively high level of employment of tested divorced mothers, their income from their job doesn't cover the living expenses. About half part of tested single mothers their financial position estimate as tolerable, noting that the family takes care of expenditure, while the same number of mothers every month has financial difficulties. More than a quarter of children from dysfunctional families has no suitable housing conditions, a room with necessary furniture (special bed, desk, a place for playing, books and school supplies) [4].

The results of the researches in Great Brittain show that compared to non-poor, poor children lag in school achievement at the age of seven – 10 months, at the age of eleven – 12 months, at the age of fourteen even – 20 months. (Hirsh, 2005) [1].

The testing of the pupils in Canada show that pupils with higher socialeconomic status, whose parents have experience in education, then pupils from richer urban area achieve better success on tests compared to children who come from poor social layers or attend school in poor areas (Tremblay et al., 2001) [1].

III. METHODOLOGY RESEARCH

For the need of this research it is necessary that the pupils of higher grades to fill out a questionnaire that is anonymus, which includes questions related to school success. After that, each question will be specially processed and statistically shown. On this basis we can come to the conclusion if the main hypothesis is proved or disproved, and in what measure do social-family circumstances influence the success of pupils.

For the needs of this research it is created a questionnaire which consists from two parts. The first part includes the questions concerning to socialeconomic circumstances of the pupil, like the education of the parents, possession of educational learning material. The second part includes questions concerning to family circumstances, like parental help with educational material, the influence of praising and punishing on pupil's success.

It is assumed that the education of the parents , the educational status of the parents significantly impacts pupil's achievements in school. Children who come from families with high parents education reach better school success compared to those who come from families whose parents finished just elementary or high - school. Children whose parents own a higher level of education try to achieve better results in school and identify with their parents and fulfill their expectations. Children whose parents own a low level of education doesn't show the desire to give their maximum on the field of education. Parents with higher education are more interested for their children's achievements and cooperation with the school.

Getting pocket money from parents is a view of motivation for getting better grades. Often money in form of material reward increases the level of pupil's motivation for learning and in some way make them study some parts of the material they don't like.

Owning a desk for learning, and a room has positive facts on pupil's success. A room allows children untethered learning and full concentration on education material, and efective preparing for the class.

Educational materials in family determine school success. Children who at home have some educational materials like television, computer, books achieve better success in school because they have additional sources which they can use in educational purposes.

The degree of parent's involvement is closely correlated with school achievement. Children most of the time are learning with their mothers, less of their time with their fathers.

Material rewards (pocket, scholarships, toys, travels) and unmaterial (praise, attention) determine pupils view on school achievements. On the other side, punishments have a hard fact on school success, but just if they are used according to the situation.

IV. CONTRIBUTION

Author: Trnavac, N. (Lecturing society of Serbia). The questionnaire is modified for the aims of the research..

Questionnaire for pupil's of elementary school higher grades

1.What is the educational qualification of your parents?

Father: a) unfinished elementary school
b) finished elementary school
c) finished high school
d) finished higher school
e) finished faculty

Mother: a) unfinished elementary school
b) finished elementary school
c) finished high school
d) finished higher school
e) finished faculty

2. Do you get pocket money from your parents?
a) yes
b) no

3. Do you have your own room?
a) yes
b) no

4. Do you have your own desk for learning?
a) yes
b) no

5. Does your family owns (round off):
a) telephone
b) television
c) video
d) radio
e) computer
f) car

6. Do your parents help you with your learning?
a) yes
b) no

7. Do your parents praise you when you bring a good grade?
a) yes
b) no

8. Do your parents punish you when you bring a bad grade?
a) yes
b) no

Thank you for your sincerity!

V. CONCLUSION

The main aim of this research was questioning the influence of socio-family circumstances on elementary school pupil's success. It is presumed that socio-family circumstances have a great influence on school success. Children from poor families have lower achievements in school because of the lack of educational materials, lower parental education, etc.

In order to improve the success of pupils, it is desirable that each school provide spaces with the necessary educational materials which would help that pupils, especially those from poor families to use them for the aims of education. It is also necessary to organize some seminars and workshops for parents, which can help them educate their children, and realize what is their role in the school system. It is recommended to maintain parent-teacher meetings, but on the other hand, the interest of parents for these activities must be present, so there could be achieved good results.

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THE EFFICIENCY OF APPLICATION OF INFORMATION TECHNOLOGIES IN TEACHING AT HIGHER EDUCATION INSTITUTIONS IN THE REPUBLIC OF SRPSKA

N. Đalić
University of East Sarajevo, Faculty of Transport and Traffic Engineering, Republic of Srpska
djalic8@yahoo.com

Abstract – By introducing the information technologies in the teaching process, there has been a change in traditional teaching. The use of information technology in the teaching process encourages the improvement of the quality of teaching. The application of information technology at higher education institutions in Republic of Srpska has great significance and important educational effects for both teachers and students.

I. INTRODUCTION

Information technology (IT) is a technology that uses computers for data collection, processing, storage, protection and transmission of information. The term information technology is associated with communication technology as today it is impossible to operate with the computer if it is not connected to a network, and so the term information and communication technologies (Eng. Information and Communications Technology - ICT) is introduced.

Higher education is neither technical nor economic issue, but above all, a matter of survival, the question of development opportunities and prospects for freedom and happiness – of individual, communities and nations. [10] The reform of the higher education should be a development imperative. For this reason, the aim is to change the content of education in general, and particularly in higher education. The main task of higher education is that young people are professionally trained for work that they will encounter later. It should never neglect the shaping of the young man as a person, as well as his ability in the future to constantly build its social and professional knowledge.

The problem of the entire educational system is that over time the volume of material that the student must adopt has increased and a way of teaching has not changed for centuries (changes have happened, but in the essence the principle is still the same).

The traditional teaching is the most common frontal form of work with a strong function of teachers lecturing and it leaves no space for interaction between students or leaves time for independent activities of students in the function of better realization of teaching contents. Teaching is usually formalized, verbalized and for pupils hard to understand, which reduces the durability of knowledge and ability to use theories in real life.

However, in the last ten years, massive use of computers in schools created conditions for better educational technology innovations. Multimedia programs designed for personal computers offer us a variety of options for electronic books with text, images, animations, sound and movies, so that students can progress independently in mastering the syllabus, they can return the content that they are not clear enough to receive feedback and additional information in accordance with their capabilities and interests. Interactivity and quality of the presented material by using multimedia and hypertext provides much more extensive facilities in comparison to teaching that takes place in traditional classrooms.

II. THE DEVELOPMENT CONCEPT OF INFORMATION TECHNOLOGY

By using the information technology, the main didactic concept gets extensive form in which the reversible routes, apart from students, professors and teaching content equally participate in information technology methods, forms and principles that change the educational paradigm. Fig.2.

The new educational paradigm is oriented towards the students, which is located in the center, while is surrounded with learning resources both in terms of time and place and ways of learning.

Digitalization of existing scripts or textbook students come easily to the learning materials. The possibility of faster searching throughout the textbook increases the importance in exploiting the teaching material. Materials in electronic form ease students the process of facilitates routine operations copying and formatting, because for these purposes they use software tools.

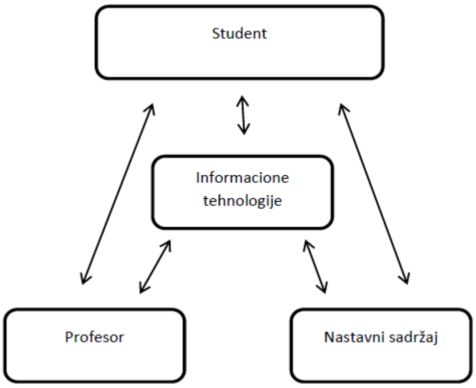

Figure 1. Pedagogical paradigm of teaching

III. The Application of Modern Technologies in Teaching Process

The more powerful, more minimized, simpler to manage and cheaper information technology brings great changes in education.

The teaching process at higher education is in between of constant organizational changes and changing technologies of educational work. Innovation in teaching is a novelty introduced into the educational reality.

In the educational process, information and communication technologies represent a very important part. Information technologies go through all areas of school work and activities, both in the field of administrative work, communication, archiving data in electronic form, to the application of information technology in the teaching processIn the educational process, information and communication technologies represent a very important part. Information technologies go through all areas of school work and activities, both in the field of administrative work, communication, archiving data in electronic form, to the application of information technology in the teaching process.

Information technology represents the "study, design, development, implementation and support or management of computer information systems, software applications and hardware." [6]

Under the information technologies in education, the study of characteristics and possibilities of electronic information resources and adequate implementation of modern didactic media in the function of innovating technology teaching and learning, is considered.

The educational process, which is carried out with the help of information and communication technologies in practice, can be found under the term e-learning. E-learning can be characterized as a way of learning using information technology, as the performance of educational process with the help of information technology or as ELECTRONICAL aided learning.

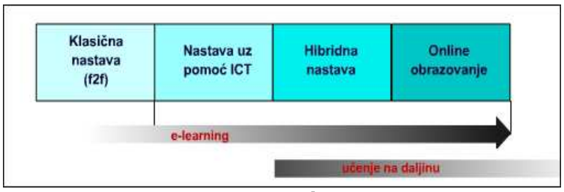

Figure 2. E-learning

The installation of application programs, networking and engineering computer hardware, designing software and databases, as well as designing complex computer networks and information systems belong to the domain of information technology. The application of information technology in education is crucial, because proper acceptance and understanding of the concept of information and communication technologies, and the creation and implementation of partial segments, represents one of the imperatives of modern society ready to respond to the demands of the modern age. Results of previous studies show clear benefits of ICT in the teaching process compared to traditional teaching, both in terms of quantity and in terms of the quality of the acquired knowledge, its durability and applicability, and greater engagement in the learning process, the development of abstract thinking, the ability to process learning, the ability to grasp, solving the problems and creative potential, which effectively puts knowledge of the development of human capabilities. [7]

More frequent application of digital technology, application software, as well as greater representation of multimedia classrooms at universities in the Republic of Srpska, testifies on more and more improved and modern teaching process.

Based on its implementation, information technology in the teaching process, ensures time and relevant information provided by monitoring implementation of the education process, and making time significant decisions, as well as the high standard of teaching staff and students during their education in part of creating, storing and sharing information and knowledge.

The use of information technology in higher education is aimed to modernize the existing technology, monitor new processes, and young professionals which are educated in accordance with the needs of society and the economy.

The current trends in the introduction of information technology show that their use has been to maintain a higher concentration of students compared to the traditional way of teaching. The traditional form of teaching, where the lecture is the central part of the teaching process, is undergoing through changes by introducing information technology in teaching.

Computer devices enable a completely different organization of teaching and educational work, appropriate abilities and interests of each student, then provide better and more efficient, emission, transmission and absorption of knowledge. Experiments have also shown that in terms of quality and quantity of acquired knowledge, the durability of that knowledge, teaching and learning with computers is more effective than traditional teaching.

Computer teaching and learning is suitable to the development of abstract thinking, enabling planning direction and individual progress in acquiring knowledge.

IV. The Improvement of the Education Process by Application of Information Technology on Organizational Units of the University of East Sarajevo

The application of information technologies in organizational units of the University of East Sarajevo can be seen in all segments of the organization starting from the management till teaching process.

The need for the use of information technology in various faculties are reflected in the possibility of covering all information flows in the managing of the education system, in accordance with the tasks that are performed in the system.

Since information systems are expected to provide the basis for the execution of various tasks and requirements that participants set to the system. Thus there is a need for complex and efficient information technologies required to design, construction and operation of information systems. [5]

Information technologies have become an important element in the development of society, and therefore the recognition of the need to apply in the management of higher education institutions is one of the key factors in the further development and inclusion in the modern trends of modern society.

Strengthening of information structures in the Faculty of Transportation in Doboj contributed to the purchase of new computers for computer rooms, classrooms, a library, and fixed projector, projection screen, personnel and group printers that enable easier teaching at this University organizational unit.

Digital and media competence, the development of educational portals, establishing online services, development of platforms and educational materials related to the curriculum, determining the virtual learning context, the possibility of electronic exam application and application of electronic student identification cards represent different aspects of the integration of information and communication technologies in the organization of instruction in higher education institutions, making it more efficient, better quality, most innovative and globally relevant. The gradualness and continuity in education management of higher education institutions for the implementation of software solutions in the management of universities, as well as Monitoring and Evaluation of ICT strategy project at the level of the education system are based on the implementation of ICT and new pedagogical paradigms in higher education.

V. Conclusion

The teaching system will inevitably have to be adapted to the changes in education which have emerged from the influence of information technology. The main objective of introducing information and communication technology in the educational process is fast, accurate and reliable knowledge acquisition.

Equipping classrooms with computer equipment and turning them into "digital classroom", as well as ongoing training and development of teachers to use such classrooms create the necessary preconditions for massive use of information communication technology in the teaching process. Application of informational and communication technologies has its place in the modern classroom. Today's generations of students are computer competence and have shown great interest in the use of modern technology.

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PARENTAL ATTITUDES ABOUT PRIMARY SCHOOL STARTING AGE

T. Alimpić, D. Radosav
University of Novi Sad, Technical Faculty “Mihajlo Pupin“ Zrenjanin, Republic of Serbia
tanjce_yoo@yahoo.com

Abstract - In this paper the author has shown a research performed in Primary School “Stojan Novakovic” in Sabac this March (2015), when pre-school assessment of future first year primary school children is also carried out. This paper represents the overview of parents’ attitudes and opinions as well as of findings of research about primary school starting age.

Starting from a hypothesis that parents are against the premature start of primary schooling, a survey of parents was performed, and its findings have confirmed our assumptions.

I. INTRODUCTION

As parents, we have a key role in the development of our children. When the time comes to hand them over to their teachers, children already acquired most of basic skills in a successful manner. A happy, self-confident child, who knows that learning is pleasure, will start primary school easily and will be eager to participate in activities.

Children who start primary school this way will complete it with satisfaction and huge self-confidence. Whether a child can add two numbers or write their name is of minor importance. It is important for a child to be confident about their capabilities and skills. Among the most important knowledge to pass on to pupils is understanding that learning is one of huge life pleasure. If a child is aware of being “capable”, they will be willing to learn. If they think they are “incapable”, they will be rejecting learning. Of course, no one does everything right, but if a child is assured it will succeed, they will be persistent in attempts. Self-confidence is essential and it is much more difficult for passing on than reading and writing skills, and its importance is invaluable.

Compulsory education in our country is performed through eight-year primary schooling and is achieved depending upon circumstances and conditions in certain regions. In its character, it is a general educational basis for all youth aged six and a half to fifteen.

II. THEORETICAL RESEARCH

For the purpose of establishment and demonstration of a relation of specific segment of population or a particular individual to various social matters, their attitudes about such matters are determined.

Attitudes are willingness to react either in an affirmative of negative manner to specific kinds of facilities or events (*Dr Nikola Rot, Osnovi socijalne psihologije, Beograd, Zavod za udzbenike, 1972).*

It is exactly the fact that attitudes always indicate whether we are for or against something, that makes difference between attitudes and personality traits, and they at a later stage show the manner of someone’s behaviour. For a more complete knowledge about attitude nature, essential attitude characteristics should be pointed out.

The first attitude characteristic is that attitudes are dispositions. It means that attitudes are features, which have their physiological-nervous basis, and that they become emphasized once such physical bases are activated which happens when one gets in touch with events towards which they have an attitude.

Another attitude characteristic is that they represent a disposition degree. Attitudes form based on lifetime experience. Parental attitudes determine their behaviour towards a child as well as how they will raise them. Therefore, attitudes influence parents’ behaviour, and all of that influences a child’s behaviour, either. Parents with their attitudes also influence the development of complete child’s personality.

In course of human society development, family (parents), as a significant factor of personality development, was the subject of consideration of numerous scientific disciplines. However, researches about connection between family environment and the development of child’s personality do not have such long tradition.

Family variables, such as family social-economic status, and parental behaviour towards their children, have become the subject of intense researches worldwide during last twenty years. Parents are adult, mature people who already possess certain social affirmation, tasks and responsibilities in our entire life. Each of them organizes their own family life in a way that they desire, can and know.

The first and main problem, which appears in relation to schooling, is an issue of when a child is mature for attending classes that is primary school starting age. Our curriculum is thus set that a child with average talent becomes capable of starting primary school at the age of six and a half that is seven. It is not favourable to take into account that among children of that age there are huge individual differences in capabilities of successful fulfillment of curriculum. Some children are mature for admission to school at the age of six, but some of them are not ready to start school at the age of eight, either (*Dr Marjan i Tea Kosicek – I vase dijete je licnost, Zagreb, 1965, p.321*).

Primary school starting age is determined by two variables (pursuant to the Elementary Education Act):

- year of birth, that is age, and
- maturity that is readiness, preparedness for school.

In accordance with our Law on Education, all children who turn seven by 1st March of next calendar year shall start school, if psychophysically capable. If they are not ready, school start is delayed for a year. If lagging behind is considerable, Classifying Commission is engaged.

Enrollment delay occurs in case of health issues, being recommended by a medical specialist treating a child. This means that, in certain cases, when it is in a child's best interest, pursuant to Article 23. Of the Law on Modifications and Amendments to the Law on Education, a pedagogue or psychologist may postpone school enrollment by a year, based on the Multidisciplinary Commission's opinion, which includes evidence on delay need as well as proposed measures for additional educational, health-related or social child support in the period until school start.

By means of testing a child when enrolling school, possible difficulties of a future first year, primary school child in learning and adjustment to school may be detected, as well as their inclinations and talents.

Even a child younger below the age of six may enroll school if a commission consisting of: a psychologist, physician-pediatrician, pedagogue and teacher estimate that such child is ready to attend classes. The commission work is regulated by Expert Manual, which, among other things, states that the decision of the above commission is final and that no complaint may be lodged against it. This provision was adopted in for the purpose of children's protection and increasing parents' pressure their children to start school prematurely.

The Law states that a child may start school if they are developed adequately mentally and physically. This definition implies the criteria related to regular school start. That is why it is required firstly to define maturity, readiness or preparedness for school.

Readiness for learning is a child's willingness to accept training. Such willingness implies physical, intellectual, emotional maturity, prior experience and motivation for learning.

- Physical maturity implies the existence of physical preconditions for attending classes and completion of school obligations (height, weight, power of upper and lower extremities, general power, vitality, fine motor skills etc.).
- Emotional maturity implies stability of emotions and appearance of higher emotions (intellectual, moral ones).
- Social maturity refers to separation from parents, inclusion in the company of peers, acquisition of order, acceptance of obligations and duties, social sensitivity.
- Intellectual maturity implies greater attention, quality of long-term memory, logical operations.
- Prior experience refers to acquired knowledge about things from surroundings regarding natural and social phenomena.
- Learning motivation refers to interest and curiosity about school learning. A child's eagerness to learn at school has to be based on realistic apprehension about it as well as requirements, which will be set to them once they become pupils.

A child needs to know how to control their emotions has to be capable of and ready to cooperate with other people, and solve conflicts in a socially acceptable manner.

A child who is ready to start schooling has a positive attitude towards school, and is delighted about it as evidence that they are grown-up and mature. Such attitude should be supported since it facilitates learning, acceptance of obligations and overcoming the difficulties.

A child does not need to be specially prepared for starting school. Before starting school, a child does not have to be able to read, write, calculate – they will learn that at school, that is why they start school.

A pre-school child should have certain knowledge and skills, but they are not learnt through the imposition of learning but through play and talks in everyday life situations. This includes: graph motor skills, concept of figure value, speech and vocabulary, acquired skills of reading and writing, time and space orientation.

All maturity aspects interact with each other and each of them is equally important, meaning each of them can cause problems if it fails to reach a required level in relation to school requirements.

In the context of the above review, an issue of groundedness of predictions and expectations is imposed, as well as of possible problems in connection with children starting school.

However, problems are possible and they really exist, but they are hard to notice. They are often minimized because they are compared with school success, which is, for many people, the most significant indicator of school training efficiency.

Based on the researches performed at schools, the following areas of possible problems have been identified:

1. a parent,
2. a school expert associate (a pedagogue or psychologist),
3. a child,
4. a teacher, and
5. school.

Pedagogues have been dealing with an issue of primary school starting age for a long time. Parents themselves have different opinions and attitudes towards this issue. That is why we have faced a problem of this research:

To which extent are parents interested in premature school start or regular school start?

For many parents, marks given by psychologists or pedagogues have a great authority and may considerably shape their apprehension about capabilities and personality of their own children. A mother from Kragujevac explained this as follows: “I was not indifferent about what I will find out from a psychologist. I have always considered my child smart, but I was not sure. He is still my child therefore; it can happen that I miss something. When I found out that he had had excellent test results, I felt somehow relieved.”

Primary school starting age differs in surrounding countries in comparison with our country. For instance, in the Republic of Croatia, children start school if they are six by April 1st current year, and primary school lasts for eight years.

In the Republic of B&H, children start primary school at the age of six and it lasts for nine years.

In Slovenia, children start primary school at the age of six and it lasts for nine years, as well.

In accordance with researches of Golubovic S., Rudic S., Rapaic D., *Connection of Risk Factors at Birth with Manifestation of Development Problems and School Start Delay*, the greatest percentage of delayed school starts represents children born preterm.

Descriptive method will be used in this research.

Descriptive method refers to the description of pedagogic phenomena. Descriptive method provides an insight into current state, that is tends to perform screening of descriptive research subject matter. By this method, facts are stated as well as things to which such facts refer.

As many methodologists believe, range and character of descriptive method is conditioned by the answer to four key questions:

1. What will be described during the research,
2. How long will the research subject matter will be described,
3. How the research subject matter will be described, that is researched,
4. Why a thing described and what is is the objective of performed descriptive research.

As with other pedagogical researches, on selection and definition of the subject matter, objective, tasks, hypotheses and variables of a research, an answer needs to be given to some predefined questions. It is the first task in every research (the first stage, content of the first scientific-research project), so is in the one relying on descriptive method. If a precise and clear answer is given to such questions, then it would not be difficult to answer the following ones either: on what kind of sample will the facts be collected, how will they look like in terms of their type and character, how will collected facts be identified, classified, arranged and processed.

Descriptive method is not limited only to description, collection and arrangement of data, but it also includes comparison and confrontation, valuation and interpretation of data. Within descriptive method, in the collection of empirical facts we used techniques, procedures and instruments (questionnaires, scales, tables).

Within a single research method, various procedures or techniques (manners, in a narrower sense) of research work are applied. Techniques allow the attainment of a set objective in a systematic and planned way.

The questionnaire we created is a research instrument, which was used within surveying as a research technique. Surveying is such research procedure (technique) in which participants are asked some questions to which they are to provide their answers. Questions are in written. The answers provide facts (data) which refer to subject matter of research.

The collection of facts is performed with equal questions. Participants are asked questions about matters supposedly known to them and they are requested (by means of suitable questions) to provide facts they are familiar with. With such questionnaires, objective data (facts) are collected).

Types of survey questions, i.e. questionnaires:

a. closed-ended (all possible answers are provided)
b. open-ended
c. combined questions.

The questionnaire defines parental attitudes, opinions and beliefs about primary school starting age.

Population is determination who is the research subject matter and in what manner. Basic statistical approach – population from which we chose statistical units for the research sample includes parents of future first year primary school children who belong to the territory of Primary School “Stojan Novakovic” in Sabac, in course of this March (2015), when pre-school assessment of future first year primary school children is also carried out.

A research sample is a final part of basic set for the purpose of the examination of a specific feature (*Gojkov, Krulj, Kundacina, 2002, p.294*).

III. Research Findings

In our research, sample includes parents whose children belong to classes in central school “Stojan Novakovic” Sabac as well as in suburban and rural school departments in: Letnjikovac, Pocerski Pricinovic and Gornja Vranjska.Sample data are shown in below tables. Presented data clearly shows that this is a deliberate sample, which we chose at our sole discretion.

TABLE 1. Structure of Parents’ Sample by Territorial Units

Primary School Territorial Unit	Number of Participants	f %
“Stojan Novakovic” – Sabac	20	20
“Stojan Novakovic” – Letnjikovac	65	65
“Stojan Novakovic” – Pocerski Pricinovic	7	7
“Stojan Novakovic” – Gornja Vranjska	8	8
Σ	100	100

TABLE 2. Structure of Research Sample by Education and Sex

Education of Parents	Sex		Total
	Female	Male	
Primary School	4	5	9
Secondary School	25	28	53
Three-Year Post-Secondary Education	13	8	21
Higher Education	11	6	17
Σ			100

TABLE 3. Structure of Research Sample by Age

Age of Parents	Number of Participants	f %
26-30	40	40
31-35	31	31
36-40	22	22
41-45	7	7
Σ		100

TABLE 4. Structure of Research Sample by School Area

Area	Number of Participants	f %
Urban – Sabac	20	20
Suburban – Letnjikovac	65	65
Rural – Pocerski Pricinovic	7	7
Rural – Gornja Vranjska	8	8
Σ		100

TABLE 5. PARENTAL ATTITUDES ABOUT PRIMARY SCHOOL STARTING AGE IN VIEW OF SEX

Sex	Parental Attitudes about Primary School Starting Age			Total
	supporting regular school start	neutral	supporting premature school start	
Male	40	2	5	47
Female	47	/	6	53
Total	87	2	11	100

TABLE 6. PARENTAL ATTITUDES ABOUT PRIMARY SCHOOL STARTING AGE IN VIEW OF EDUCATION OF PARENTS

Education of Parents	Parental Attitudes about Primary School Starting Age in View of Education of Parents			Total
	supporting regular school start	neutral	supporting premature school start	
Primary School	4	1	4	9
Secondary School	45	1	7	53
Three-Year Post-Secondary Education	21	/	/	21
Higher Education	17	/	/	17
Total	87	2	11	100

TABLE 7. PARENTAL ATTITUDES ABOUT PRIMARY SCHOOL STARTING AGE IN VIEW OF AGE OF PARENTS

Age of Parents	Parental Attitudes about Primary School Starting Age in View of Age of Parents			Total
	supporting regular school start	neutral	supporting premature school start	
26-30	32	1	7	40
31-35	27	/	4	31
36-40	21	1	/	22
41-45	7	/	/	7
Total	87	2	11	100

TABLE 8. PARENTAL ATTITUDES ABOUT PRIMARY SCHOOL STARTING AGE IN VIEW OF SCHOOL AREA

School Area	Parental Attitudes about Primary School Starting Age			Total
	supporting regular school start	neutral	supporting premature school start	
Urban	19	1	/	20
Suburban	62	1	2	65
Rural	6	/	9	15
Total	87	2	11	100

TABLE 9. PARENTAL ATTITUDES ABOUT PRIMARY SCHOOL STARTING AGE IN VIEW OF PARENTS' LOCATION

Parents' Location	Parental Attitudes about Primary School Starting Age			Total
	supporting regular school start	neutral	supporting premature school start	
Urban Area	14	1	/	15
Suburban Area	67	1	2	70
Rural Area	6	/	9	15
Total	87	2	11	100

TABLE 10. PARENTAL ATTITUDES ABOUT PRIMARY SCHOOL STARTING AGE IN VIEW OF PREVIOUSLY ACQUIRED EXPERIENCE

Previously Acquired Experience	Parental Attitudes about Primary School Starting Age			Total
	supporting regular school start	neutral	supporting premature school start	
YES	41	/	/	41
NO	47	1	11	59
Total	88	1	11	100

IV. CONCLUSION

Research findings have shown that 87% of parents support school start at the age of six and a half that is seven, which proves our hypothesis that the majority of parents does not support premature school start.

Sub-hypothesis 1.-*It is assumed that there is no statistically significant difference among parents in parental attitudes about primary school starting age in view of sex* – Research has confirmed this sub-hypothesis since 40% and 47% of males and females respectively support regular school start.

Sub-hypothesis 2. - *There is no statistically significant difference among parents in parental attitudes about primary school starting age in view of age*.- In accordance with data presented in Table 7, we can see that 80% of parents (age 26-30), 87% of parents (age 31-45), 95% of parents (age 36-40) and 100% of parents do not support premature school start and there are no significant differences in view of age.

Sub-hypothesis 3.- *There is a statistically significant difference among parents in parental attitudes about primary school starting age in view of education* – Research findings confirm this claim since only parents with primary and secondary education support premature school start, as shown by findings presented in Table 6.

Sub-hypothesis 4.- *There is a statistically significant difference among parents in parental attitudes about primary school starting age in view of school area* – This sub-hypothesis has been confirmed, as shown by research findings presented in Table 8, i.e. even 60% of parents whose children attend a rural school support premature school start.

Sub-hypothesis 5.- *There is a statistically significant difference among parents in parental attitudes about primary school starting age in view of parents' location* - This sub-hypothesis has been confirmed, as shown by research findings i.e.

81,82% (rural area) and 17,18% (suburban area) of parents support premature school start.

Sub-hypothesis 6. - *There is a statistically significant difference among parents in parental attitudes about primary school starting age in view of previously acquired experience* – This sub-hypothesis has been confirmed, as shown in Table 10, since all parents with previously acquired experience did not support premature school start.

From psychological aspect, such research findings are interpreted in a way that parents think that their children will achieve more than parents themselves will, if the children start school prematurely. Of course, such attitude is not grounded, for numerous reasons, which are indicated among the criteria for measurement of child’s readiness to start school.

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ASSOCIATION RULES IN DETECTING USERS' BEHAVIOUR PATTERNS IN ONLINE ENVIRONMENTS

M. Blagojević
University of Kragujevac, Faculty of Technical Sciences Cacak, Republic of Serbia
marija.blagojevic@ftn.kg.ac.rs

Abstract – The paper presents the application of association rules in detecting users' behaviour patterns in online environments. The research was done within Moodle LMS. Results show the significance of data mining techniques in the organization of teaching.

I. INTRODUCTION

Data growth in certain processes brings forth the need for the data analysis and detecting behaviour patterns. General solution for this problem is data mining techniques. According to [1], data mining presents detecting useful patterns of behaviour or connections in large amount of data.

Association rules introduce one of the techniques for detecting behaviour patterns, which is most frequently applied in shopping. The task of the association in data mining is to set rules in data basis. The association is known as the analysis of consumer basket and it is aimed to detect rules according to which the links between two attributes are created. The association does not contain any in advance defined output attributes, but every attribute can be both the cause and the effect of the revealed rule. The principle of the association is IF attribute A THEN attribute B, and the significance of the rule is determined based on Support and Confidence. The Support is proportional part of the sample members who satisfy certain rule (No. of satisfying members/total No. of members), whereas the Confidence shows the proportion of the members who possess both attribute A and attribute B.

In this paper, the association rules are used for determining useful behaviour patterns in the domain of e-learning. At universities, it is the learning management system (LMS) that has been most frequently used in the last decade. This system provides numerous possibilities for organization of teaching through various forms of lessons, tests and collaborative modules (forum, wiki, chat).

There have also been numerous researches regarding the application of rule association in the problems of e-learning.

According to [2], the focus is on is the possibility of successful application of association rules mining in research problems related to e-learning. In this research, the previously mentioned model has been used to show rare association rules when gathering student usage data from a Moodle system. The relevant results have been presented in the comparison among several frequent and rare association rule-mining algorithms.

Furthermore, the authors in [3] suggest the application of association rules in the environments for e-learning through descriptive examples and the conclusions arising from them.

Research specificity presented in [4] is related to the new approach of pre-processing data, so that the association rules can be applied appropriately. The mentioned research is aimed to analyse users' behaviour, provide help in learning evaluation and improve the structure of SCORM content.

II. RESEARCH METHODOLOGY

A. *Participants*

Research participants are students of Faculty of Technical Sciences Čačak who are also the users of Moodle system for managing e-learning. Currently, the number of active users is approximately 2000, whereas the LMS (Learning Moodle System) approximately covers 150 courses.

B. *Research Objective*

Research objective refers to determining the possibility for the application of rule association in the problems of e-learning. In addition to this, the research objective relates to establishing connections between the modules and course activities.

The modules imply individual possibilities provided by LMS and available to users. An example for this can be forum, lesson, wiki...

Activities include the actions that users perform, for example viewing, editing, deleting...

C. *Research Tasks*

The research has been conducted through particular tasks, which enable the realization of the set objectives.

The research tasks are as follows:

- Data Collection
- Data Selection
- Creation of *'association rules'* model
- Analysis
- Discussion of the results

III. RESEARCH RESULTS AND DISCUSSION

The research results have been shown in the previously mentioned tasks.

A. *Data Collection*

The data have been collected from the server on which the Moodle learning management system is located. Moodle LMS provides the possibility to export records regarding the users' activities in many formats. The following format .csv has been selected.

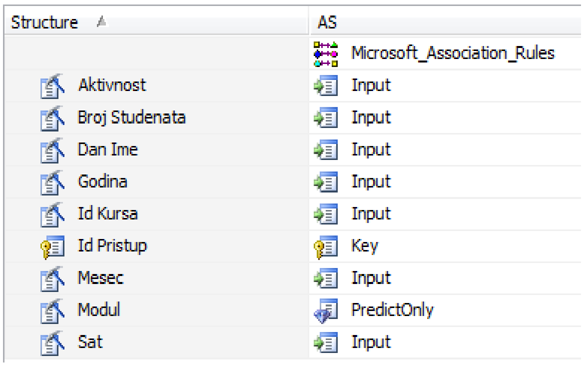
B. *Data Selection*

Taking into consideration the number of the created electronic courses on the Moodle platform (itlab.ftn.kg.ac.rs), all courses besides the courses intended for entrance exam preparation and degree finals have been selected.

C. *Model creation, evaluation and testing*

In this paper, we used the association rules technique. The model was created and evaluated in Microsoft Visual Studio 2010 [5] environment, but it was tested within Microsoft SQl Server Management Studio [6].

Figure 1 shows the structure of '*association rules*' model.



Structure	AS
	Microsoft_Association_Rules
Aktivnost	Input
Broj Studenata	Input
Dan Ime	Input
Godina	Input
Id Kursa	Input
Id Pristup	Key
Mesec	Input
Modul	PredictOnly
Sat	Input

Figure 1. Structure of 'association rules' model

Figure 1 shows the structure and the name of the model (AS). As far as the structure is concerned, the list of attributes is available, as well as the view of input, output and the attribute being predicted. In this research, the module is the attribute, which is being predicted.

Evaluation of the created model has been performed through lift chart.

Lift chart measures the model efficiency calculating the difference between the results obtained with the aid of the model and without the model. The results obtained without the model are based on randomly selected records. Lift chart is used for graphic representation of the improvement provided by '*analysis data'* model. The graph represents the comparison of prediction accuracy among all models, in order to determine general prediction accuracy, or prediction accuracy for a particular value. Result comparison in the lift chart for various models brings about additional information regarding the type of the model best for specific research problem.

Figure 2 presents the main parts of lift chart.

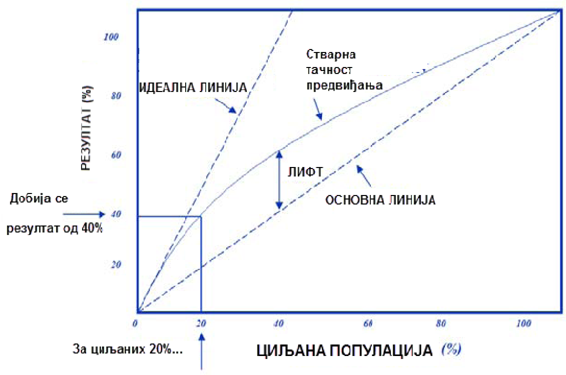


Figure 2. Main parts of lift chart [7]

According to the shown example, the principal line presents the prediction in the random sample in which, i.e. in the sample of 20% of population the achieved result is 20%. This result relates to typical return data obtained without the application of any data analysis model, and based on the presented example 1. The presented chart presupposes that certain target value was set. Model evaluation is performed and the improvement provided by data mining model for a specific value is presented for the target value.

Figure 3 presents the lift chart for the performed research.

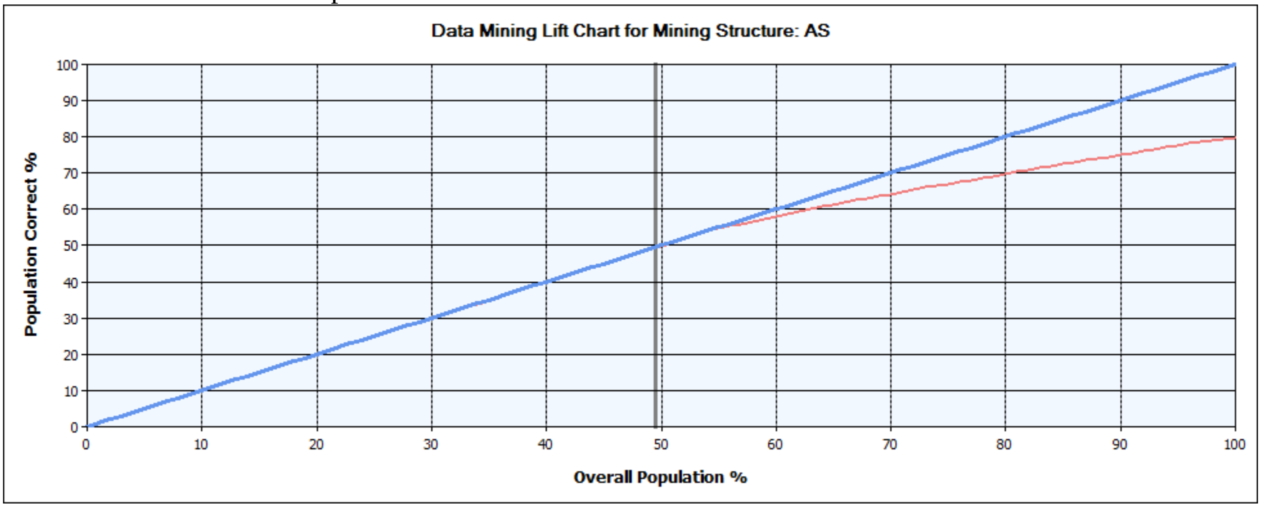


Figure 3. Lift chart

In the previously mentioned type of chart (without aimed value of the output attribute) principal line does not exist. Nevertheless, the ideal line and the line regarding the created model are displayed.

In Figure 3, the ideal line is marked with blue colour, while red denotes actual accuracy of prediction. Legend was given in the separate part (Figure 4), according to which the accuracy of the created model can be analysed.

Series, Model	Score	Population correct
AS	0.91	49.98%
Ideal Model		50.00%

Figure 4. Legend for analysis of accuracy

According to the results from the presented table, the following can be concluded: out of 50% of the total tested population, 49,98% is accurately predicted by the created data-mining model. Considering the fact that the ideal model of 50% of population predicts 50% of the cases, the created model has deviation of 0.02% from the ideal, thus it can be considered very accurate.

Vertical line in the chart is on 50%, as well as the results in legend for the analysis of accuracy. The vertical line can be moved causing the change in legend results. In this research, the results have been presented for 50% of population. As described in Example 1 (target group for campaign conducting), in this case of 50%, we can reduce cost and choose a part of the sample. By applying data mining model, a significant improvement can be achieved in comparison with random module selection.

Testing of the models has been conducted within Microsoft Visual Studio and Microsoft SQL Server Management Studio.

Figure 5 and Figure 6 show some of the results from the environment Microsoft Visual Studio.

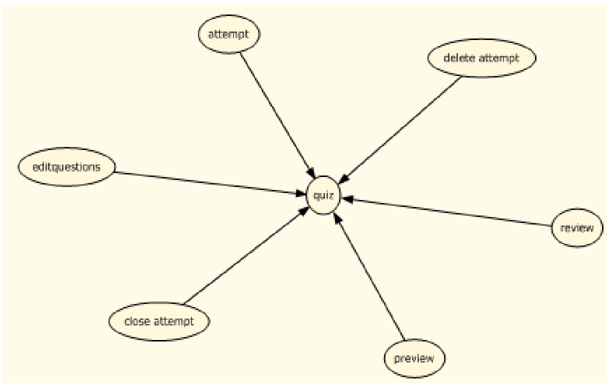


Figure 5. View of connection between modules and activities

Figure 5 presents the connection between each of the module and possible/probable activities. Figure 6 gives insight into individual cases. A group of items in a case is called an itemset. An association model consists of a series of itemsets and the rules that describe how those items are grouped together within the cases. The algorithm identifies the rules, which can be used for predicting the future attribute values compared to the modules, depending on the existing ones.

Figure 6 presents some of the obtained results.

Probability	Importance	Rule
1.000	2.621	Aktivnost = submit, Dan Ime = sreda -> Modul = questionnaire
1.000	2.612	Aktivnost = submit, Id Kursa = 84 - 111 -> Modul = questionnaire
1.000	2.624	Aktivnost = submit, Mesec >= 10 -> Modul = questionnaire
1.000	2.616	Aktivnost = submit, Sat = 14 - 18 -> Modul = questionnaire
1.000	2.618	Aktivnost = submit, Mesec < 4 -> Modul = questionnaire
1.000	2.616	Aktivnost = submit, Sat = 10 - 14 -> Modul = questionnaire
1.000	2.623	Aktivnost = submit, Sat >= 18 -> Modul = questionnaire
1.000	2.648	Aktivnost = submit, Id Kursa = 22 - 84 -> Modul = questionnaire
1.000	2.668	Aktivnost = submit, Godina = 2011 - 2013 -> Modul = questionnaire
1.000	2.366	Aktivnost = add contact -> Modul = message
1.000	2.325	Aktivnost = add contact, Dan Ime = petak -> Modul = message
1.000	2.329	Aktivnost = add contact, Sat = 7 - 10 -> Modul = message
1.000	2.332	Aktivnost = add contact, Dan Ime = ponedeljak -> Modul = message
1.000	2.329	Aktivnost = add contact, Dan Ime = utorak -> Modul = message

Figure 6. View of rules, probability and importance

Besides some of the rules, Figure 6 shows the importance and probability.

For example, for the rule Activity=submit, DayName=Wednesday-> Module=questionnaire, probability is 100%, and the importance is 2.621.

The importance is designed to measure the usefulness of a rule. Although the probability that a rule will occur may be high, the usefulness of the rule may be insignificant in itself. The importance column addresses this. The greater the importance, the more important the rule is.

IV. CONCLUSION

Taking into consideration the obtained results, we can draw conclusions on the possibilities of the application of association rule mining in the problems of e-learning. The results reveal the link between modules and activities and they give rules with individual attribute values. Future work regards creating the questionnaire for predicting future patterns of users' behaviour via the created model.

V. ACKNOWLEDGEMENT

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GRAMSCI IN EDUCATIONAL SCHOLARSHIP

H. Hajrullai
South East European University, Language Center, Tetovo, Republic of Macedonia
h.hajrullai@seeu.edu.mk

Abstract - One of the most outstanding social theorists of the 20th century is undeniably the Italian writer and politician Antonio Gramsci (1891-1937). In addition to the fact that he theorized social issues, he provided a concrete solution regarding certain social phenomena that at the time were virtually unrecognized as such. "Hegemony", "Ideology", and "Organic Intellectuals" are only some of the terms coined by Gramsci that are used today in numerous contexts and for different purposes. It is beyond questioning that Gramsci had a global impact on social sciences. The influences of his social theory are well recognized and broadly accepted in the field of education as well.

In order to examine more closely some of Gramsci's influences on education we will demonstrate several articles on educational scholarship that clearly show this influence through the way these specific social theorists analyze, examine and interpret educational phenomena in different societies. In order to accomplish this purpose, the article provides an overview of articles which were heavily influenced by Gramsci's work in educational context. This comes as a result of the attempt to understand and make sense of certain social phenomena by offering realistic solutions to issues pertaining to society.

I. INTRODUCTION

All of the social theorists I have examined until now have been exceptional in their own way. They undoubtedly present their individual analysis of social phenomena which naturally vary from case to case. While some of these theorists were keener on hypothesizing social phenomena, others endeavored to make sense of certain social phenomena by offering realistic solutions to issues pertaining to society.

One of the most outstanding social theorists of the 20th century is undeniably the Italian writer and politician Antonio Gramsci (1891-1937). In addition to the fact that he theorized social issues, he provided a concrete solution regarding certain social phenomena that at the time were virtually unrecognized as such. "Hegemony", "Ideology", and "Organic Intellectuals" are only some of the terms coined by Gramsci that are used today in numerous contexts and for different purposes. It is beyond questioning that Gramsci had a global impact on social sciences. The influences of his social theory are well recognized and broadly accepted in the field of education as well.

In order to examine more closely some of Gramsci's influences on education we will demonstrate several articles on educational scholarship that clearly show this influence through the way these specific social theorists analyze, examine and interpret educational phenomena in different societies. In order to accomplish this purpose let us look at:

II. HEGEMONY, RESISTANCE AND THE PARADOX OF EDUCATIONAL REFORM - HENRY A. GIROUX

This particular article reveals, in all probability, the finest example of the application and reflection of Gramsci's social theory. In it Giroux draws attention to specific issues concerning the structure of the society such as: power, culture, hegemony, as well as education and how these interrelate in the society with the aim of maintaining the existing reproductive model.

> "The point here is that there are some serious deficiencies in existing theories of reproduction, the most important of which is the refusal to posit a form of critique that demonstrates the theoretical and practical importance of counter-hegemonic struggles both within and outside of the sphere of schooling." (p. 3)

This paragraph unmistakably exemplifies the application of Gramsci's theory on educational aspect. Giroux identifies that the lack of transformative models in schools and societies enables hegemony to preserve the current situation of educational, political, economic and social reproduction. This is also very similar to Gramsci's theory and critique of the bureaucratic centralism of bourgeoisie hegemony and the impact on social reproduction as not challenging to the existing order.

Like Gramsci, Giroux seeks ways to improve the current social situation by questioning the various models used for the social governance of capitalist societies. Giroux uses the model of raising consciousness among the oppressed strata as means to challenge the internalized hegemony. In an educational aspect, he sees the development of a radical theory of education as a way of challenging the existing social model.

"Theory of pedagogy that accounts for the relationship between structure and intentionality on the one hand, and point to the need for a connection between critical theory and social action in the other" (p 4)

Radical pedagogy does indeed have the potential to increase awareness and decode the interplay of power, hegemony, ideology and education as ways of existing social reproduction. These social theorists moreover introduce various ways of resistance to the constricting models in the society, as well as define and question the state of duality in the reinforcing or criticizing existing models.

However, at this stage I am asking what is the role of the radical pedagogy here? Does it play a reformative or a transformative role? And which one of these is more relevant to oppose the existing social reproduction?

Giroux's answer would probably be that radical pedagogy is both reformative and transformative. While the reformist character of radical pedagogy is only in changing people's minds concerning the current situation, is this enough to completely transform a society? Apparently not, in order for radical pedagogy to achieve its goal it needs to have a transformative character as well.

> "Similarly the ultimate goal of radical pedagogy is not simply one of changing people's consciousness or of restructuring schools along more democratic principles; such aims are important but are reformist in nature and incomplete when viewed within a radical problematic. At the core of any radical pedagogy must be the aim of empowering people to work for a change in the social, political and economic structure of class based power and domination" (p. 23-24)

In addition, Giroux further elaborates the interface between hegemony, power, culture and ideology as a way of maintaining existing social structures in a favorable position of hegemonic domination over the oppressed ones. His reference to Bernstein, Bourdieu, Althusser, Bowles and Gintis simply confirms that the social reproduction model reinforces hegemony and that the same structure of education fashions both identity and experience influencing the same way on education as well.

Giroux maintains that the current structure of education influences the production and consumption of knowledge in a way that limits access to equal education and it uses education to maintain the social reproductive model.

It is also important to stress Pierre Bourdieu's view of cultural reproduction as contributing to dominant social reproduction. I have to state that there is a point where I somewhat agree and disagree with him. I agree with his claim that:

> "In other words, objective structures (language, school, and economics) tent to produce dispositions, which, in turn, structure social experiences that produce the same objective structures."

In other words what he is stating is that "habitus" operates and functions as another way of hegemonic reproduction. This is contradictory to my opinion, since if a person becomes more educated, more culturally aware (speaks different languages, knows different cultures etc.) he or she is more likely to be critical of the social, political and economic circumstances in his country.

III. Beyond Neoliberalism in Education - Gandin and Apple

This article is yet another example of application of Gramsci's hegemonic social theory. The article clearly demonstrates how articulation, disarticulation and rearticulating are necessary in reestablishing and redefining the socially oppressed and marginalized classes of a society as well as referring the same to education.

One of the ways of achieving this reestablishing and redefining is through the Citizen School project:

> "If we are to understand the case of the Citizen School we have to investigate the particular rearticulations forged at this locale, since part of the political/ethical/educational project that is going on here is both to counter the neoliberal and neoconservative attempts at transforming the our common sense and to build a new one much more based on participatory principles" (p. 151)

Gandin and Apple's idea of articulation of the current social and educational circumstance and building new ones are based on the necessity for more participation, which is similar to Gramsci's theory of improving the situation of the socially marginalized in the circle of the social reproduction. The Citizen School project involves inclusive measures of building a new social order based on the needs of not only of the dominant hegemonic strata, but inclusive of those historically and socially marginalized groups within that society.

This social theory finds its way into the education as well. It serves as an example to education how a number of already establishes dominant hegemonic frames can be questioned and challenged as well as changed in a way that will serve the purpose of improving access to those previously (educationally) marginalized members of the society.

But how can this function, in praxis, within educational terms? According to Gandin and Apple, educational transformation can be possible by changing the approach to design of the curriculum. Thus far the curriculum has largely evaded open discussion about issues concerning the society under neoliberal circumstances. A newly designed curriculum would not only include pertinent social issues, but would provide a space for open discussion, and possible solution, of these.

The other Gramscian social theory employed in this article applies to the educational dimension and is the theory of "organic intellectuals." In this context the authors explain how the Citizen School project influenced the creation of the new circumstances in education opposing the existing ones and implying their own.

> "The Citizen School created spaced in which multicultural practices are organically integrated, not only added artificially to a bureaucratically determined structure that is aversive to "difference" (p. 171)

At this point I ask myself if this is it. Is it this easy to overrule the hegemony in question? Is the hegemonic bureaucratic class going to give up that easy?

Apple and Gandin make a good point of the fact that achieving these goals to opposing this hegemony is no easy task. The authors warn us of the possibility of fact that the way democracy is articulated in order to favor the neoliberal position also creates the possibility of rearticulating new circumstances that would yet again serve and favor the neoliberal politics.

This caveat should also concern educational institutions as well. Since education is one of the most sensitive aspects of social transformation, this claim sends a warning message to the schools as well for the repercussions and consequences of possible re-politization of the educational arena.

"Hegemonic groups themselves constantly attempt to forge new articulations and win back the space for their own use. Thus, education remains a site of struggle." (p 161)

IV. The Education of Blacks in the South - James D. Anderson

Anderson is another exceptional social theorist whose theories, besides the fact that influences on other areas of social life, find application in education as well.

In this particular article he discusses the historical oppression of the African-American minorities in the South and their constant struggle for educational inclusion in social reproduction. In this article Anderson successfully demonstrates two things: first, the contradiction of liberation thought, since schooling was a part of emancipation but also was used by whites as a tool for domination and oppression; second, he successfully illustrates the developmental stages of organized refusal of the ideology of the dominant hegemony.

Hegemonic oppression by the dominant majority over African-Americans was done to maintain position of power, enabling continuous exploitation favoring White political, economic and educational dominance. Part of African-American liberation was also the desire to read and write. The hegemonic forces rejected the idea of public schooling for African-Americans seeing their education as potential threat to their domination. Even though providing education for African-Americans had an emancipatory interest, it still overemphasized the hierarchical division and place of African-Americans and Whites in the society.

Despite facing enormous obstacles, African-Americans managed to organize themselves with the intention of establishing their identity and to enable an input in the social reproduction and rupture the dominant frames of practiced hegemony.

> "Ex-slave communities pursued their educational objectives by developing various strata, but the one they stressed the most was the leadership training. They believed that the masses could not achieve political and economic independence or self-determination without first becoming organized, and organization was impossible without well trained intellectuals-teachers, ministers, politicians, managers, administrators, and businessman." (p 28)

V. From Indios to Professionals: Stereotypes and Student Resistance in Bolivian Teacher Training Aurolyn Luykx

Luykx demonstrates yet another social phenomenon that ties social theory to education. He exemplifies how hegemonic forces influence identity formation and how the same might be withstood. It is interesting that the propaganda of the hegemonic ideology is typically transmitted through education. This is also the case with this specific article, where the "Indios" are forcibly taught to become "Professionals".

However serious problems occur, as illustrated in the article, during the attempt to homogenize a hugely dissimilar population. In the case of Bolivia, resistance to this massive change appeared to be more successful than the project itself. The hegemonic phenomenon of identifying itself as a certain race, language or ethnicity was impossible to achieve in circumstances where "Indios", even after educated to be "Professionals", were still considered (and mostly remained) as "Indios":

> "The professor answered resolutely that he goes on a being *campesino*; the peasants cannot change his essence no matter how much he might imitate city dwellers. The first student objected but the professor overruled him, reiterating that the *campesino* might live according to urban costumes, but he remains a *campesino*. *(p. 252)*

There is no doubt that these artificially promoted homogenous tendencies are not only doomed to failure in the Bolivian society, but also reflect the impact of capitalist and liberalist preference of individual over the community. Yet we have to keep in mind that the level of forced political ideology will never be the same to educational ideology, although it my serve to the political one.

VI. CONCLUSION

In conclusion, social theory has been always closely connected to education. They not only serve each other, but also fulfill each other in terms of presenting a more global (and realistic) image of a social reality. While social theory and education are usually susceptible to any social change, they will maintain their counter-hegemonic character and serve as tools in developing awareness of social circumstances and how the same affect our lives. In the examples of educational scholarship above, we have not seen only the influence of the social theory in constructing social reality, but also the influence on stimulating constant critical reasoning as well as questioning the existing structures and methods used by governments to maintain hegemony.

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THE TERM OF MODEL AND MODELING

A. Terek, M. Pardanjac, I. Tasić
Technical faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
angiterek91@gmail.com

Abstract - The main aim of this paperwork is to explain what modeling and model mean, which types and classifications of models and modeling exist. Modeling is the general process of the human brain. That is a cost-effective use of something instead of something else with the aim to reach some particular knowledge. The result of modeling is a model. Model is a simplified and idealized picture of reality. Model is an imitation, prototype and projection of an object with past, present and possible future reality.

I. Introduction

Model theory and simulation has an universal meaning and a big significance in scientific researches. Physical modeling exists as long as human being, but the scientific approach starts in the XVII century. With the computer development, modeling and simulation are becoming more prevalent as a way of solving the most complex problems. Education in general, teaching, thinking process and the process of learning are not sufficiently examined in the light of model theory and simulation.

Modeling and simulation can be applied to the system, teaching in general, but also to teaching technical education, which can be seen as a system, so it is possible to apply the methods of modeling and simulation.

In the process of learning applying specific models, especially heuristic, has his own usage. Especially it is important the usage of models and simulation in the process of learning, both in frames of educational system and self-learning with the help of a computer (E-learning, programs for learning from a CD, electronic textbook...)[1].

Model is an abstraction of a real system, which retains only those features of the original that are important for the research. The level of abstraction affects the validity of the model, the successful representation of the real system through the model. Too complex models are expensive and inadequate, but on the other hand, too simple models don't reflect the observed system on the real way [2].

II. Model

The term model is based on the existence of some similarity between two objects. That similarity may relate to the internal structure of the objects which outside can be very different, it can also relate to certain behaviour characteristics of the objects, which don't have any common features, neither in form nor in structure. Also, similarity can be related to external characteristics of different objects.

„If we can establish similarity between two objects in any particular sense, then between those two objects exists the relation of the original and model. This means that one of those objects can be viewed as the original, and the other as his model."

The model contains just the important features of the original, or the real system which will only be built. There are many different definitions of the term model, but the point is substantially conciding. Dr Bogdan Sesic under the concept of the model sees: "Generally, model is every, theoretical, conceptual, steady, practical, real object of the research, by which it can be explored some basic subjector system"[1].

Prof. dr Sotirovic Velimir gives this definition of the term model: "The term of a model is based on detecting the existence of similarities between two objects or systems. One of the system object is an original and the other is his model" [1].

Prof. dr Nadrljanski Dordje is giving a similar definition of a model: "It is usual to consider a model as a synthetic abstraction of reality. Conclusion can be derived for the relationship of the original and the model: if we can find similarities between two objects in any particular sense, then between those two objects exists a relationship of original-model. One of the objects is the original and the other is his model".[1]

Models can be divided according to the number of different viewpoints: According to their material (structure) models can be physical (which are further divided into iconic and analog) and symbolic. According to the behavior in time they are divided into static, dynamical. According to the way of solving they can be conceptual, mathematical, simulational. It can be said that these last three types of model are three stages of development.[3]

For cybernetic systems the most important similarity is the similarity of their behavior. This similarity makes it possible to establish a relationship of original-model, and based on that the movement can be modeled. When it is about modeling the system for which are important just the input and output values it is used the term of ”black box”. Under the term of “black box” it is considered a system for whose observation are essential and available just the input and output values, and his interior decoration is irrelevant. In this way we can objectively examine the systems whose internal organization is too complex or unknown, to draw conclusions based on the behavior of the component of these systems and the structure of relationships between them [1].

A. Model classification

In the modeling process must be met certain conditions so it could fill its goal:

- The model must be similar to the object-original,
- The model must be obvious and clear,
- There must exist a feature of correspondences between the model and the subject of the original,
- The model must be applied in the sense that in many ways it can be incorporated into the teaching process,
- The model must provide a specific information about the original,
- The model must be inexpensive.

The main aim of modeling and simulation is that the data of the behaviour of the original (object, appearance, process, system) don't get by studying the original, but it constructs a model whose experimentation leads indirectly to the data about the behaviour of the original [1].

B. Simulation modeling

Simulation process is a structure of solving real problems with the help of simulation modeling. It can be described as a serie of steps that make up some individual phases solving problems using this method, that follow one after another, not strictly sequentially, because returns to the previous steps of the process are possible, depending of the results that are obtained in the various stages of the process. The general steps of simulation modeling are:

- Defining the aims of simulation studying,
- Identifying the components,.
- Collecting data of the composition and analysis,
- Building a simulation model,
- Building a simulation program,
- Verifying a simulation program,
- Evaluation of a simulation model,
- Planning simulation experiments and their performance,
- Analyzing the results of the experiment,
- Conclusion and recommendations.

Constructing and using simulation models, by some rules, requires a work of a team of experts, and those whose observed composition is an object of interest and also requires a work of IT specialists. In complex projects it may be a team composed of several dozen experts with different abilities, while in simpler cases it may be one or two people who simultaneously know the composition, methods and techniques of simulation modeling. Simulation model can be realized in the form of a computer program that mimics the behavior of the real component. [3].

C. The types and classes of models, principles of modeling

Depending on if it is the object, process, appearance real or ideal, individual, special, general, concrete or abstract, these are the following divisions of models:

- Real model in ideal – all thought models of real objects are ideal,
- Concrete model in abstract – abstract models are the generalization of real objects, processes, appearances and legality (mathematical, physical or chemical formulas),
- Ideal model in real – this group of model includes illustrations, models and other sensual perceptual interpretations of cases that are being modeled.
- Abstract model in concrete – every general representation into individual, separately or specifically belongs to this group of model.

There are three principles of modeling:

- Universality principle of object modeling – or other words every appereance, object, process or system can be modeled.

- The principle of models divercity - every appearance, object, process or system can be modeled on different ways and in different systems.
- The principle of the prototype and exemplarity – At the same time every model can be prototype and exemplare.

Every object, appearance, process or system can be modelled in different ways, in accordance with a second principle of modelling, so there are many different types of a model. There are several divisions, and the next one is based on two criteria:

- By subject area model,
- By way of modelling

Based on these criteria, models can be divided into four classes:

- Macro systems – this is a real physical model and represents the reduced original. It is used in radio technology, laboratory researches, architectural, mechanical design,
- Microsystems – this is a class of ideal models (mathematical models that describe the real process or phenomenon),
- Complex dynamical systems – this class includes cybernetic models in economy, biology, psychology, medicine, etc.
- Abstract systems – symbols which are mostly used in mathematics, cybernetics, linguistics [1].

D. Recommendations for model creation

- Establish a clear line system with the environment- include events of interest,
- Do not make too complex and detailed model
- Include important variable for system description,
- Try to develop a model into components- unity of certain functions,
- Use proven methods for the development of algorithms and programs,
- Logically and quantitatively verify the correctness of the model [4].

E. Process of model validation and verification

There is always a certain amount of skepticism when it is about the validity of the model. Therefore, it is necessary still in the construction phase and later in the validation stage to work with the end users.

There are still doubts whether the level of abstraction is well-balanced and will approximation of real systems threaten the degree of model validity.

The process by which we examine how the model accurately describes the originals usually takes place in two stages:

- Verification phase (this phase exists when it comes to computer simulation model. Checks if the program itself is consistent with the model and whether in some stages there are errors, comparing conceptual model with the computer code).
- Validation phase (Iterative method examines how the behaviour of the model is in accordance with the real system. All rigid differences are recorded and analysed so the model upgrades and improves. The process is repeated until the behaviour of the model does succeed the required precision).

The process of validation and verification in ceratin parts match, so if the model does not produce the expected results, both procedures should be properly implemented and at the same time to examine whether the input and output data are in the range that ensures the correct behaviour of the model. The first step in model realisation is the observation of the real system and the identification of interactions between components of the same. The modelar must not recon only on his own observation, but it is desirable the cooperation with experts who know the functioning of the system and all its components. The second step is formation of a structure of a conceptual model, defining the components and the the scope of the basic parameters of the model. Next is the process of conceptual validation, where it is done the comparison of the conceptual model with the real system (original). The third step is the development of operational models (computer program, coding) [1].

F. Programs for modeling

Autodesk 3ds Max, formerly 3D Studio Max, is a professional 3D computer graphics program for making 3D animations, models, games and images. It is developed and produced by Autodesk Media and Entertainment. It is frequently used by video game developers, many TV commercial studios and architectural visualization studios. It is also used for movie effects and movie pre-visualization. In addition to its modeling and animation tools, the latest version of 3ds Max also features shaders (such as ambient occlusion and subsurface scattering), dynamic simulation, particle systems, radiosity, normal map creation and rendering, global illumination, a customizable user interface, and its own scripting language [5].

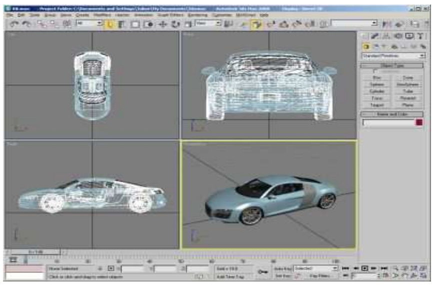

Figure 1. Modeling in 3d Studio Max

AutoCAD is the most known CAD product (Computer Aided Design), it is used for programming with computer help. It is a product of Autodesk, which is offering over 75 specialized software tools and supplies for different expert areas. The basic AutoCAD product is a sophisticated appliance design broad for universal purpose that supports 2D design, which practically replaces classical design on paper, drawing board, or replaces the 3D modeling of complex objects which in „modeling space'' can be arbitrarily rotated, displayed in projections, views, sections from all directions, with prospective effect or not, illuminate and render, so the 3D display mimics a photo of the virtual object that exists only in the computer's memory [6].

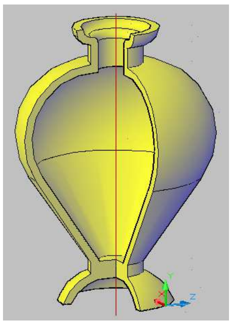

Figure 2. Modeling in AutoCAD

Maya is the state of the art program for 3D modeling, animation, effects and rendering. Autodesk Maya software is a choice of 3D artists and animators who want to get their projects stand out from the rest. It is the right content for movies, television, video-games, web-design and printing. It includes the following toolboxes:

- Modeling,
- Animation,
- Muscle and skin system,
- Visual effects,
- Rendering,
- Paint tools,
- Toon shading [7].

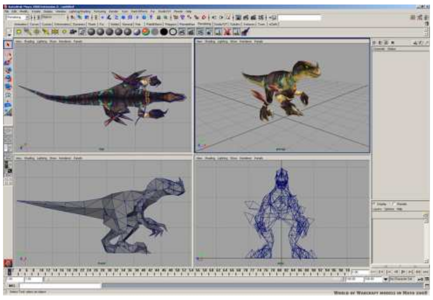

Figure 3. Modeling in Maya

III. Conclusion

Model is an abstract representation of the system, gives its structure, components and their interaction. In computer technology the model represents an instruction set (programs), which are used to generate the behaviour of the simulated system. The model has its objects in atributes and variables.

Modeling is a process which establishes a relation between the real system and the model. It refers to the validity of the model that describes how faithfully the model represents the simulation system.

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PERSONALIZATION AND LEARNING STYLES

DIGITAL GAMES AS A CONTEXT FOR EARLY CHILDHOOD LEARNING AND DEVELOPMENT

I. Stojanova, I. Kocev, N. Koceska S. Koceski
Faculty of Computer Science, University Goce Delcev – Stip, Republic of Macedonia
natasa.koceska@ugd.edu.mk

Abstract - Playing games is a very natural way of self-directed learning during the all stages of human life, especially in childhood, which is the stage of most rapid cognitive, psychomotor, and socio-emotional development. This natural way to learn through play today is supported by new technology, like mobile phones, PDA devices and tablets that are fully integrated into our lives. Many people have explored how new technology can enhance learning during children's play, and how best to support children to develop cognitively through playing activities. Although a lot of research based on developing a conceptual and theoretical understanding of designing of digital games specifically for children has been done, there is still deficient evidence about their effectiveness of children's development process.

In this context, we have decided to develop a serious game for Android operating system, using OpenGL ES 1.0 version, which support all Android devices. This puzzle game, based on a concept of task-based learning, was used for measuring children's enjoyment, engagement, tension, usability and fun. The results of the evaluation has been analyzed and shown in this paper.

I. INTRODUCTION

Play is one of the most important basic needs of children, especially preschoolers, as they learn new things try play. They learn how to deal with new situations, how to interact with others and how to control their emotions. Playing motivates children to stay engaged and concentrate for a long periods. It is also important for intellectual development, so it should be included as a vital part of early childhood education. The significance of play in learning process is strongly supported by established pedagogical theory [1-3].

There is general agreement regarding the five main functions of play in the lives of young children [4].

- Play enables children to use symbols and to represent their world in a variety of forms (Essential Learning: Communication).
- Play promotes creative flexibility in thinking (Essential Learning: Thinking).
- Play assists children to build their knowledge (Essential Learning: Thinking).
- Play fosters language and social abilities (Essential Learnings: Communication, Identity, and Interdependence).
- Play helps children operate above their usual level, by establishing a 'zone of proximal' development, meaning that the child is extended beyond previously mastered learning (Essential Learnings: Futures, Thinking, Communication).

Today children grow up with information and communication technology (ICT) embedded in their daily lives. They are being exposed to technologies at ages earlier than ever before. Many people have explored how technology can enhance learning during children's play, the role technology can and should play, and how best to support children to develop cognitively through augmented play activities [5]. Healy stated that body movements, the ability to touch, feel, manipulate and build sensory awareness of the relationships in the world was crucial to children's cognitive development [6, 7]. The main conclusion of all these researches is that if used appropriately and with suitable media content, new technologies can have a positive impact on children's development and learning. This makes it necessary to employ technologies in meaningful ways.

In the last decade, mobile games have become increasingly popular as a form of entertainment. Mobile technologies offer the opportunity to embed learning in a natural environment and provide motivational effects [8]. Games meet the fundamental needs of learning by providing player with enjoyment, passionate involvement, motivation, ego gratification, adrenaline, creativity, social interaction and emotion [9].

Although a lot of research, based on developing a conceptual and theoretical understanding of designing of digital games especially for young children has been done, there is still a deficient evidences about their effectiveness on children's development process.

With this study, we have tried to contribute in that field, measuring and analyzing different parameters during the children's play.

For evaluation purpose, we have used a puzzle game that has been specifically developed for this research. The game is designed for Android operating system, using OpenGL ES 1.0 version, which support all Android devices. A puzzle game was chosen because it represents a familiar playful activity for preschool children, which requires cognitive effort, utilizes physical manipulation, promotes collaboration and enhances emotional skills.

II. APPLICATION DESIGN

There are six key elements that should be included when developing educational games: goals, action space, choice (option), rules, challenge and feedback.

- Goals – achieving some goal is driven by a motivation to reach that goal. The goals must be clearly defined and easy to understand. In our case, they can be divided as minor goals, like raising personal ego after each success or major goals like: introduction to technology in the early years, improving fine motor skills of children hands, gaining confidence, improving cognitive and emotional skills.
- Action space - it describes the overall workspace where the user can operate or perform any actions. In our case, the action space is the screen because a game is designed to work in full screen mode.
- Choice (option) - giving freedom to choose between different options, increases the player satisfaction and enjoyment, especially when he/she encountered some difficulties. In a case of a puzzle game, player can choose which part of the puzzle to try to set. If it does not match, then he/she can choose another part and try to set it again.
- Rules – this element is closely linked to the previous one. The rules are reciprocal to options. What is not defined by the rules of the game, are choices throughout the game. The rules of our puzzle game are:
    - The puzzle is considered successfully done when all the pieces are on their correct positions before the time for execution elapsed. The time for solving the puzzle is 5 minutes. After this execution time, the attempt is considered unsuccessful.
    - If the piece is correctly connected, it cannot move.
    - If the piece is not placed on its correct position, the user can move it until he/she found its real position.
- Challenge – the content of the game itself is considered as a challenge. The challenge of a puzzle game is successfully solving the puzzle to obtain the overall picture. Nancy Maldonado states that, puzzles allow an opportunity for young children to focus on an activity that has an ending - completing the pleasing image [10].
- Feedback – is what keeps players attention and is crucial for getting insight their previous activities. Feedbacks are divided into two parts: short and long-term feedbacks. In our case the short-term feedbacks include successfully set piece of the puzzle (which is presented by a short sound), successfully completed level (presented by animation and sound), expiration of the time for performing particular level (presented by animation and sound). Long-term feedbacks include identifier of a conquered number of stars (points) within a certain level, elapsed time within a certain level, overall points scored, identifier for inclusion or exclusion of music in the game.

The design of our application is made to attract children's attention, while following the design rules and principles, which have been proven in practice [11]. Pictures of the puzzles that are used are appropriate to the age of the children (Fig. 1). There are different levels of the puzzle game: puzzles that consist of 3x3 components, or overall 9 components, puzzles that consist of 4x4 components, or overall 16 components, and puzzles that consist of 5x5 components, or overall 25 components. At the beginning, the child starts with the easiest level, and continues to the heavier levels, thus allowing constant progress of various children's skills.

The game takes advantage of touch screen technology, as a standard way of interaction used on new mobile devices. This way of interaction is very intuitive for children, as they used their fingers to drag and drop the pieces of the puzzle directly on the screen.

The competitive character of the game is achieved by winning different number of stars (points) depending on the time for solving the particular puzzle. The maximum number of stars that the player can win is three, and this number decreases with each elapsed third of the total time. If the player is not satisfied with the winning number of stars, he can go back to the same level and try to complete in less time.

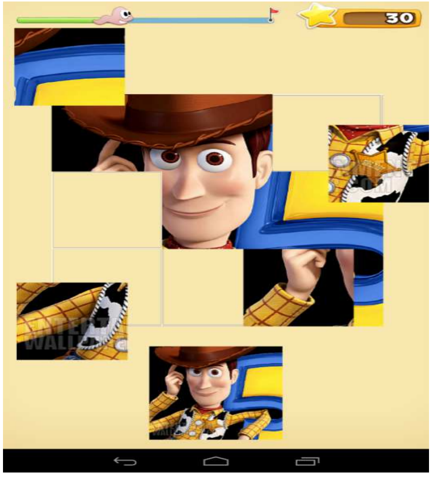

Figure 1. User interface of a developed puzzle game.

III. EVALUATION WITH CHILDREN

A. *Elements of effective learning*

When conducting a research study with children, special evaluation methods are required. This is because children differ from adults; they have their own likes, dislikes, needs and requirements [12].

Children find informal learning fun when they enjoy and are engaged in the activities. Enjoyment and engagement are integral and prerequisite aspects of children's playful learning experiences [13-15] Prensky indicated that a combination of twelve elements make games engaging [16]. Fun and enjoyment are the most important elements of all these twelve elements. Being actively engaged in a learning activity has repeatedly been shown to be beneficial for learning [17].

Enjoyment has been found to be positively related to a desire to continue participation [18], and where the effort to increase intrinsic motivation has been widely accepted as a desirable educational practice since it leads to long-term motivation, and hence continued participation [19].

On the other hand, engagement comprises cognitive engagement, which involves attention to the activity and concentration and promotes 'useful' learning [20]. This conceptualization is relevant for children's play since a dominant function of play is learning. Learning requires engaged attention.

In our study engagement has been measured through the time recorded for the first and second completion, number of successful attempts, number of failed attempts as well as a number of moves. While enjoyment was defined and measured according to a questionnaire of the IMI (Intrinsic Motivation Inventory) model.

B. *Methodology*

IMI (Intrinsic Motivation Inventory) model is a validated multidimensional measurement instrument based on SDT (Self-determination theory) [21]. It relates enjoyment with intrinsic motivation. The IMI model includes questions divided into six subscales, which assess participants' interest and enjoyment, perceived competence, effort, value and usefulness, felt pressure and tension, and perceived choice while performing a given activity. The questionnaire is easy to modify to fit specific activities and interpret for children. In our case we have used only four of them (Interest/Enjoyment, Effort/Importance, Pressure/Tension, Value/Usefulness) with the slightly modified statements, suitable for children.

Standard IMI questionnaire utilizes a 7-point Likert scale, but in our case it was modified and a 3-point rating scale based on smiley meter was used. The smiley meter uses pictorial representations of different kind of smiley faces to represent the different level of satisfaction [22]. It has been used in different situations to measure one or more of the fun dimensions and has been proved easy to use by the children. Children were asked to circle one of the faces for demonstrating the truth level of each statement in the questionnaire.

Another model that was used in our study was Technology Acceptance Model (TAM). This model is used for measuring player acceptance of information technologies. It is also a questionnaire model that includes six constructs: perceived ease of use, perceived usefulness, attitude, intention, anxiety and satisfaction. Like the IMI method, a smiley meter scale was used with TAM model too, but with two responses only ("true" or "false").

C. *Participants*

The experiment was conducted in one kindergarten, where 20 children, aged 4 to 6, were participated in the study. The children selection was done randomly, assuming that subjects have a similar capability of completing the puzzle tasks and a similar understanding of all the questions that were presented in the study.

Participants were divided into two groups (each group consist of 10 participants). The first group was testing the developed application of the tablet PC (Fig. 2), while the second group was performing the classic way of playing puzzle (Fig. 3). This way we wanted to make a comparison of the gathered results, in order to make a comparative study.

Figure 2. Experiment using a developed Android application

Figure 3. Experiment using classical puzzles

D. Procedures

To test the puzzle game initially, a classical puzzles from the toys store in 3 different complexity versions (3x3, 4x4 and 5x5 cubes), were selected. Then, based on the images from the purchased puzzles, the puzzles on Android application were made. This was done in order to have a small as possible differences while performing the experiment.

During the training phase children form the group that work with Android application, were briefly introduced with this new technology, because there were children who have not been used tablet PC previously. The touch screen interaction with the tablet was explained, as well as the way of moving puzzle parts in order to solve it.

The training phase for the second group, working with classical puzzles, was omitted, because the children were familiar with this issue. Instead, this group was passed directly to the testing phase.

During the testing phase, participants were working on randomly selected puzzle, but it was taken into account, each child to get puzzle of varying difficulty and to try to solve it. The time required for solving the puzzle, the number of correct and incorrect attempts, as well as remaining time, was measured during this phase.

After the twenty-minute play session, children were asked to complete questionnaires (according to IMI and TAM model that were previously explained). The survey was conducted with the help of the teachers, who verbally explain each question to the participants.

IV. RESULTS

Results obtained during experiment were summarized and the mean value and standard deviation were calculated, for both groups (Table 1 and Table 2).

From the results it can be observed that at the beginning children need more time to complete the puzzle, but after several unsuccessful attempts their memory improves, they remember the shapes, forms and colors of different pieces of the puzzle, so in next attempt the process of solving puzzle becomes faster and the number of movement for making the whole puzzle decreases. During the experiment, it was observed that children who played a classical way get easily bored (after several unsuccessful attempts) and they wanted to switch to play on tablet PC. They did not even want to play the same puzzle again. On the other hand, participants playing on the tablet PC were much more engaged to complete the puzzle.

This coincides with the results obtained from the questionnaire according to IMI model (Fig. 4). From these results, we can observe that the children interest and enjoyment were higher in the group that was playing on tablet PC. At the same time, pressure and tension were lower in this group, compared to the group who played a classical puzzle game.

TABLE I. RESULTS OBTAINED FROM ANALYSIS OF THE DATA ACQUIRED PLAYING A DEVELOPED GAME.

	Mean value	**Standard deviation**
Total Executing Time in first trial (TET1)	0.982	0.518571114
Total Executing Time in second trial (TET2)	0.728	0.522698258
Time Remaining (TR)	1.018	0.518571114
# of Successful Trials (ST)	11.8	3.42928564
# of Failed Trials (FT)	21.7	8.283115356
Total Number of Trials (TNT)	33.5	10.08216247

TABLE II. RESULTS OBTAINED FROM ANALYSIS OF THE DATA ACQUIRED WITH A CLASSICAL WAY.

	Mean value	**Standard deviation**
Total Executing Time in first trial (TET1)	3.697	2.398370488
Total Executing Time in second trial (TET2)	\	\
Time Remaining (TR)	\	\
# of Successful Trials (ST)	12.4	3.611094017
# of Failed Trials (FT)	28.6	27.55793897
Total Number of Trials (TNT)	41	27.17719632

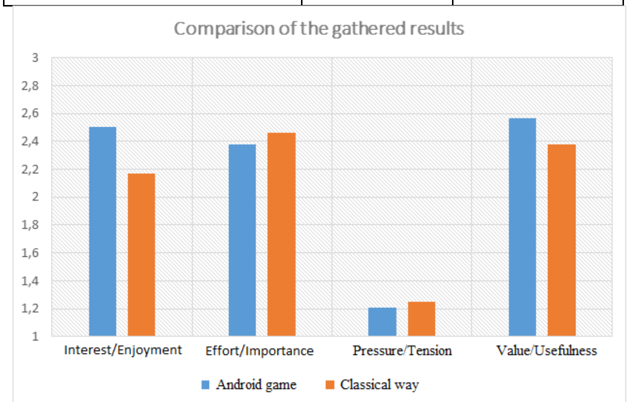

Figure 4. Comparison of the results gathered from the survey according to IMI method

Results about the children's acceptance of new technology were gathered from the questionnaire according to TAM model. About 90% of all participants answered affirmatively that playing game on tablet PC using touch screen technology was easy and fun, even for those children who have not been used this technology before.

V. CONCLUSION

There is no simple and unique answer to the question: What is the best way that young children learn? However, one thing is obvious, living in the era of digitalization, interactive mobile games should have more practical role in the learning process, because they are fun, engaging and motivating for young children.

For the purposes of this study, an Android application was developed according to the standards required for preschool children. The game was tested for various parameters as children's enjoyment, engagement, interest, tension, value, usefulness. The results of the evaluation showed that when designed appropriately games can encourage and motivate children and thus positively affect the learning process.

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DEVELOPMENT OF HANDICAPPED CHILDREN COMMUNICATION SKILLS USING TOUCH USER INTERFACE

B. Sobota*, D. Petríková**, L. Jacho*, Š. Korečko* F. Hrozek*
*Department of Computers and Informatics, Faculty of Electrical Engineering and Informatics, Technical University of Košice, Slovak Republic
**Spojená škola Pavla Sabadoša, Prešov, Slovak Republic
branislav.sobota@tuke.sk; ladislav.jacho@tuke.sk;

Abstract - Handicapped people encounter serious obstacles every day. Some of them can be overcome using information technologies, which can offer attractive solutions for life-affecting situations. On the other hand, the world around us is full of symbols. They can be found on consumer goods packaging, road signs, warnings, etc. A symbol represents an idea encapsulated into a simple drawing. Its purpose is to understand the given situation better. When teaching children to read, it is required that the text used is not impersonal. The purpose of the text is not only to give information; it should also "touch" the child and provide understanding. One of the promising directions in the teaching is to use texts composed of symbols. It can be implemented by means of natural virtual reality user interfaces, available nowadays. Such implementation promises even better understanding and work that is more intuitive with computer devices. This is especially true when used for handicapped people education. The paper deals with particular implementations of these technologies, developed by the authors for the benefit of the handicapped people.

I. INTRODUCTION

Increasing performance and availability of computers allows software developers to focus more on sophisticated user interface. This causes that an interaction with computer is more adjusted to user's need. [1]

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 cannot 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 are 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 cannot 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. The fairytale stories are intended to symbol verification in special needs education practice.

In the rest of the paper, we describe a system, which uses a symbol – text interface on software level and a touch interface on hardware level to support easy understanding of teaching subject. The system can also help in improvement of fine motor skills of these children. We also present a special virtual table device, which provides nearly indestructible version of touch interface and can be utilized for various purposes, not limited to handicapped people.

II. MULTITOUCH USER INTERFACE

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
- reducing of mental burden of the user.[2]

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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.[3]

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, which will be transferred through the interface and the way to implement the empirical evaluation.

III. DRAWING AND SYMBOL

Drawing is a simple and smooth activity, which is used to mark objects, actions, events, relations and is:

- an equitable way of communicating with other verbal or non-verbal methods,
- means of contact between people,
- 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 do not 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 does not depend on knowledge of specific language.

IV. COMMUNICATION USING SYMBOLS

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 color frames are used for individual symbols, with respect to the corresponding word classes:

- black frames for living nouns,
- blue frames for other nouns,
- red for verbs,
- yellow for adjectives,
- grey for 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.

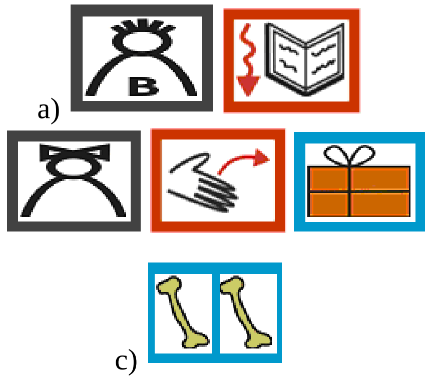

Figure 1. Examples of symbolic representation: sentence “Brother is reading” (a), sentence “A girl is giving a present” (b) and bones (c)

V. INTEACTIVE SCHOOL BENCH AND ITS PRACTICAL USE

The touch user interface and the new education method using symbols have been combined and realized in a form of an interactive school bench, developed at the home institution of authors (LIRKIS laboratory, DCI FEEI TU Košice).

a)

b)

Figure 2. Interactive school bench (a) and a child working with it (b)

The device integrates a touchscreen display and a PC computer into a standard school bench (Figure 2). In also provides a software application, which offers 11 interactive fairy tales so far: Goat and hedgehog, Three little pigs, Sleeping beauty, The Giant Turnip, Three coins, The Wolf and the Seven Young Kids, Puss in boots, Red riding hood, Gingerbread House. The fairy tales are presented in both text and symbols and the application allows testing children by matching these two forms together.

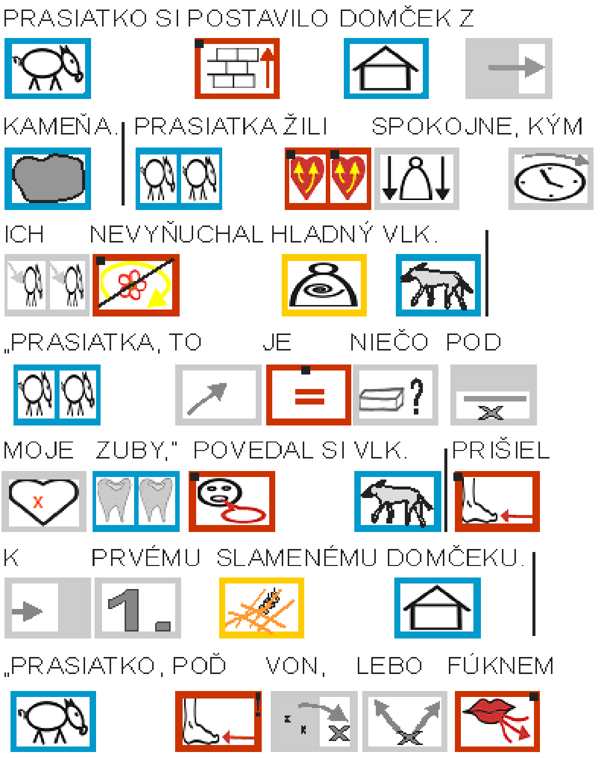

Figure 3. A part of the “Three little pigs” fairy tale, represented in text and symbols

Figure 3 shows a part of a fairytale, presented in both forms. As the application is intended for Slovak children, the text is in Slovak. Its translation to English, with the same division to rows and word order is as follows:

A pig built a house from

a stone. Pigs lived peacefully until

them don’t smell out a hungry wolf.

“Pigs, that is something under

my teeth,” said to himself the wolf. (He) came

to the first straw house.

“Pig, come out, because (I) will blow”.

This education approach, i.e. using symbols in a fairytale, is usable on various subjects and in home environment for kids with different level of handicap. It can be also suitable for healthy children who cannot read yet nor have difficulties with reading. Drawings affect psychosomatic perception of children, enhance experience from reading texts, and provide cultivated thinking and esthetical experiences for children.

VI. Fine Motor Skills, Limits And Evaluation Methods

Limitations in handicapped people fine motor skills often cause a bad estimation of strength when working with a computer system. This can lead to a damage of user interface devices. Despite improvements in pressure resistance of touchscreen displays, we do not recommend to use them when a person with these problems starts to work with a computer.

For such cases, we developed a virtual table device, which can replace the touchscreen. The device provides a solid surface on which an image of user interface is projected by a data projector. The user touches this surface instead of the touchscreen. The touch is detected using a depth camera. In the current version of the device, the Microsoft Kinect sensor provides the depth camera. This hardware also disposes with RGB camera with resolution of 640x480 pixels, accelerometer and microphone, which can be used to eliminate limits of the touch user interface, i.e. a person can say the name of the key instead of touching it.

Virtualizations of the objects, which are manipulated by handicapped people together with the abstraction of symbols, improve interactivity and attractiveness of the whole solution. Oversized objects can lead to better manipulation, low latency of the user reactions and comfort of the system use. One of the indicators of the user interface quality is the ratio of successful interactions with graphical elements to the attempts to interact and the device can be modified to measure the ratio. Another advantage of the device is that it can detect a touch by nonconducting items (e.g. prostheses), which is not possible with a capacitive touchscreen. The size of touch surface is adjustable, so it is suitable for users with limited fingers mobility.

The device is not only useable for handicapped people training; it can be also used for healthy people, for example workers in a factory. In this case, an image of a machinery interface is projected on the table surface and a worker can be trained to hit controls of the interface in a proper order according to corresponding situation. In Figure 4, we can see that the surface on which the interface is projected does not need to be flat. Here controls are projected on white boxes.

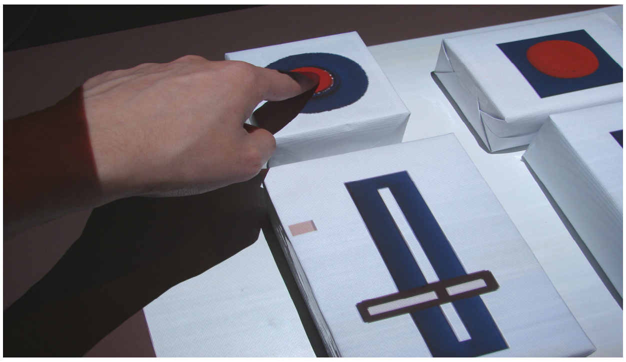

Figure 4. A user working with industrial controls projected on the virtual table surface

VII. CONCLUSION

Multi touch user interface for handicapped people could improve fine motor skills and help them to get used to mobile devices. People with various disabilities can use developed software implementing teaching method using symbols to better understanding of written texts. The computational system using this communication type becomes barrierless and acceptable to use for handicapped people on daily basis.

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MODEL OF SOFTWARE FOR CHILDREN WITH SPECIAL NEEDS

I. Zdrakanovic, M. Stefanovski, E. Tobolka
University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
isidorazdrakanovic992@gmail.com, miroslav410@gmail.com, tobolka@eunet.rs

Abstract - If we are concerned with adapting the user interface in applications for people with special needs it is actually told about the interaction of these people and computers. Inclusion of persons with special needs in mainstream life and work is very important because a very large number of people have problems with vision, hearing, a physical lack or psychological problem. People with special needs use computers and information technology every day, and like other users, they use computers for work, information, entertainment, and so on. Furthermore, information technology and computers are being developed in a way to provide, with their technological discoveries, to this group of people to facilitate the everyday problems they have because of their handicap. Adaptive, that is Assistive Technology (AT) is the name for the computer technology adapted to people with disabilities, which is help in the use of computers. This is an entire branch of the IT industry, which is working on developing of hardware and software for people with special needs. IT industry has developed a variety of educational software to facilitate the daily lives of people with any type of deficiency.

I. INTRODUCTION

The progress of computer technology has brought the opportunity to choose and upgrade the basic package with those programs that exists on the market and which is specifically made to support the work in certain areas. The very existence of these opportunities of adaptation helps users to work better, more independent, more creative, and more effective, as well as to develop their preferences and potentials in the area concerned. Since people with special needs face many obstacles in their daily work, individuals have come to the conclusion that it is precisely information technology provides a solution to this problem. The modern era provides a new opportunity for people with special needs to be included in society, but also a new danger to these people who can remain behind even greater barriers because of reduced accessibility. Those who have unequal opportunities for access to information, represent a population at risk who might lose basic human rights. If technology is not accessible to persons with disabilities, or the information is processed in a manner that is not appropriate for certain groups or persons with special needs, they become excluded from the IT society.

II. ACCESSIBILITY

The term accessibility is often used to focus on people with disabilities or special needs and their right of access to services and goods, often through use of assistive technology. Accessibility is therefore associated with the area of human rights and the variety of legal mechanisms to protect human rights.

Figure 1 - Accessibility

The presence of accessible technology in schools is important for several reasons. The first and most important is that many countries have legally committed to the schools to ensure equal access to technology for students with special needs, which means adapting to the needs for students with special needs. Among the many reasons for the adoption of the law on equal access is inclusion of students with special needs in regular teaching. Computer is an important and powerful tool, and it is known that the possibility of getting a job for people with special needs is being increased. Integrating accessible technology in schools and presenting them to people with special needs from the first day of school, will not only accelerate their learning, but also increase their opportunities for employment in the future. Unfortunately, inaccessible materials mark the children with special needs, preventing them to use the same materials as their friends, and this often limits their ability to acquire knowledge. In order to secure the same access to technology for students with special needs as the students who have no special needs already have, manufacturers of software solutions for improvement of productivity and developers of software solutions that are used in education, have begun to include children with special needs in the process of developing the program. The Internet offers the ability to access a vast amount of information and interaction for many people with disability. For example, some physical damage limit the types of jobs that person can perform. However, affordable Internet expands opportunities for communication, interaction and employment of persons with disabilities and therefore informational accessibility is particularly important precisely for people with disabilities.

III. What Is The Educational Software?

Educational software represents intellectual technology and it is called educational software, which includes the programming languages and tools, the particular organization of teaching and learning based on logic and pedagogy [1]. The development of educational software is a very complex process. It has to fulfill some pedagogical factors, as well as some of the factors in the field of computing. Users, especially children, have to realize and understand the principle of navigation on the screen. Navigating from one scene to another has to be enabled by special commands, which are clearly visible. Multimedia contents are one of the most important aspects on which the educational tools differ from books. Although multimedia has great importance in the effectiveness of software, it may also have a negative impact.

IV. Adaptation Of Educational Software For Persons With Vision Impairment

The computer has become an indispensable means of communication, source of information, entertainment, and work engagement. By itself, the computer operates on the principle of visual, because each man receives most knowledge just over eyesight. However, the question is how a person who has partially or completely visual impairment can use a computer. Computer can significantly reduce the disadvantages caused by disablement and provide information. There are various tools that contribute to people with visual impairments can normally use their computers, enjoy them and have a better future and employment. Visual impairment is usually classified as low vision, color blindness, and blindness. A traditional product assistive technology used by blind people is called a Screen Reader. Screen readers are programs that read images and text that is displayed on the screen aloud. Because blind users do not use the monitor screen, screen reader is used to verbalize, or "say" everything that is on the screen including names and descriptions of the control buttons, menus, text, and punctuation marks. Software for the blind - JAWS for Windows is the most popular and most widely used screen reader in the world. It is distributed worldwide in more than 50 countries and it has been translated into 23 languages. Screen reader JAWS enables blind and visually impaired persons to benefit equally from most applications on the computer. A JAW monitors user activity on the computer (keystrokes and commands) and reads the content of the screen. It supports standard Windows and other popular applications for small and large users, such as Microsoft Office Suite, Internet Explorer ™, Firefox ™, MSN Messenger, Corel WordPerfect, Adobe Acrobat Reader and many others. Interactive Voice installation allows the blind and low vision user to install and setup on an equal footing with sighted users [2].

AnReader is a speech synthesis system intended primarily for blind and visually impaired. The software supports Microsoft SAPI4 and SAPI5 interface, so that it can be used with all major screen reader programs (NVDA, JAWS, Window-Eyes, ...). Share to Speech - Belgrade Labsii company, headed by Ivan Ičin, has launched an application called Share to Speech, which allows sound reproduction of different text formats - links from the web (supports 13 different programming languages), Word, PowerPoint, PDF, etc., and also storing them for later use, and even downloading the MP3 file. Although it is intended for those who want a different way to receive useful content, the greatest interest is in those older than 55 years, probably in large part because of low vision.

V. Adaptation Of Educational Software To Persons With Mobility Impairment

When it comes to people who have problems with mobility, that is housebound people; information technologies usually go out to meet through assistive technology (AT). This branch of the IT industry is engaged in developing hardware and software for people with special needs. Scientists from the Institute of perceptive artificial intelligence Dalle Molle, together with colleagues from Lausanne, Barcelona and London, have made a wheelchair that will be in the near future controlled solely by brain activity. "The certain branch of AT assists those who scarcely or use their hands or they do not use them at all. For a complete "hands-free" control of computers it has been created a number of special programs (for example, ScanSoft’s Dragon Naturally Speaking), which allow you to get full control over the computer only by voice.

Figure 2 - ScanSoft’s Dragon Natrally Speaking

For people with severe disabilities, such as persons with an injured spine that do not have any control over the upper limbs, this system has support in the form of special hardware. These are substitutes for a mouse that can be controlled by the movement of the iris of the eye. One such device is the Quick Glance, operational on all Windows’s OS.

Today, tablets and mobile phones with the Android OS are in use more and more, every day reveals new applications for these devices. In the pile of novelties, the application "Accessibility map" has appeared. This application is precisely designed to immobile people. This geolocated software displays all accessible facilities and public areas to immobile people. This application was created and designed to facilitate the movement of these persons. This application was initially developed for mobile phones and now it is accessible for computers. Accessibility map allows users to locate accessible and inaccessible objects and in that, way movement is planned in accordance with their needs. It is important to emphasize that the use of this application can be mapped and examined not only the physical characteristics of the object, but also its contents and services that exist within them.

Figure 3 - Accessibility map

EVAS (www.evas.com) is another company that is devoted to the production of computer equipment for people with disabilities. In cooperation with the company Dell, they create computers for people who have hearing difficulties, vision difficulties, who have physical defects, and learning problems. They specialized in complete solutions, so they supplied PCs with all the necessary applications. QualiWorld is software that is primarily intended for persons with physical disabilities. It helps them with everyday tasks, such as written and verbal communication, surfing the Internet, watching television or listening to the radio; they performed independently through applications that adapt easily to customers. A special part of this package is QualiEye, which allows access to a computer without using hands. Using a standard web camera, this application tracks the movements of the head and body, which are converted into cursor movements on the screen, providing a precise and efficient control of the cursor in real time. Through these packages, it is possible to control the electronic devices in the house: lights, alarms, sensors [3].

VI. ADAPTATION OF EDUCATIONAL SOFTWARE TO PERSONS WITH HEARING IMPAIRMENT

Hearing impairment is the total or partial loss of ability to receive acoustic information. Hard of hearing is permanent reduction or impairment of hearing in one or both ears, which leads to a very difficult and disturbed normal voice communication. Set accessibility for persons with auditory perception disabilities includes notification of changes in the form of audio or visual notifications, volume control and assistive inscriptions. These functionalities are available in Windows 7 operating systems and its predecessors, including functionalities of SoundSentry (visual notifications) and ShowSounds (assistive inscriptions), which allow users to choose whether to receive visual notification and textual assistive inscriptions, or sound messages about system events. Applications such as Microsoft's Encarta encyclopedia have built-in assistive inscriptions, so persons with hearing impairments may use it.

Google Glass - application created by scientists at the Georgia Tech Institute that designs inscriptions on Google Glass for users with impaired hearing. The system works in the way where person impaired carries Glass while the person who he/she tries to talk to, speaks directly to the smartphone. The speech is converted to text, sent to the Glass and displayed on its display. The mobile phone is placed directly next to the mouth of the speaker, which helps reducing background noise and eliminate errors [4] Hard of hearing people have the biggest problem with communication. Especially when it comes to the electronic type of communication (e.g., telephone conversation). Conversations on the Internet are like telephone conversations except that the conversation takes place over a computer network using the Internet Protocol. Such forms of electronic communication for hard of hearing people represent a great difficulty because the acoustic echoes and background noise are often present and make it difficult to talk. When hard of hearing people try to step up the volume, they reinforce and background noise and thus more make it difficult to themselves.

In response to this problem, experts at the Fraunhofer Institute for Digital Media Technology IDMT in Oldenburg found a digital solution. In the project for improving voice telephony "Speech-Improved Telephone" sponsored by the German Federal Ministry of Economics and Technology BMV, they work on algorithms typically used for hearing aids that can at least partially compensate for the hearing loss. These are special algorithms that can be installed in all audio devices (iPod, phone system, video conference system, etc.). They work by recognizing certain frequency signal and then regulate it as necessary, adapted to the individual user. Weak signals can reinforce and loud ones remain unchanged. The point is that every person has difficulty hearing on quite specific frequencies that are often the basic problem.

Figure 4 - Fraunhofer HAS

VII. Conclusion

Computer science and technology, information technology in general nowadays are progressing. From day to day, they bring novelties with which a modern man needs to meet, to know and to use them in the best possible way. When it comes to people with special needs, it is actually told about people living with a deficiency, congenital or acquired, that cannot be improved but these persons can make their life easier using assistive tools. It can certainly be said that in this case, it has been obviously proved that computers can be as well as at the service of a man. So many new features that were unimaginable for people with special needs twenty years ago are now becoming a reality. About the accessibility of Web software to users that make persons with special needs, it must be taken into consideration, their problems must be studied and it must be approached to solve problems in the best possible way. It is also necessary to work with small children and young people with handicap in order to prepare and learn them to use technology and computers as an aid.

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THE USE OF SMART DEVICES AND THE INTERNET IN EDUCATION - THE HABITS OF K-12 STUDENTS ABOUT USING ICT IN EDUCATION IN NORTHERN SERBIA

E. Péter, K. Gábor
Bolyai Secondary Grammar School and Dormitory for Gifted Students, Senta, Republic of Serbia
esztelecki@gmail.com, korosi.gabor@hotmail.com

Abstract — According to a survey from Serbia, in Belgrade 97% of students (K-12) bring their smartphones to school every day and they use it regularly not only in breaks but on lessons too, even though the use of smartphones is not permitted. Conversely, in the Scandinavian countries student can use their mobile phones to get useful information during school classes or with a short test, the students can give a fast feedback to the teacher on the accurate parts of the curriculum. One of the biggest Scandinavian projects is the BYOD (Bring Your Own Device) in Denmark. Based on a research of UNESCU there are 6 billions of mobile subscriptions compared to the Earth's population of 7.3 billion people and it is a great possibility to reduce costs because the students bring the devices to the school.

Due to big amount of devices like smartphones, tablets, laptops the K-12 students live in a digital world: they socialize and make fun on the Internet, predominantly on Facebook; they use online contents and cloud systems for learning and so on. The European countries measure the effect of digital world on young people for years now (Eu Kids Online, Net Children Go Mobile).

The role of schools has been changed in the past few years regarding the transfer of the information. It is only necessary to show students how to find relevant and valid information. It would be important to know what they do on their devices, how many times they spend on online entertainment and learning.

In our research, we have analyzed the digital learning habits and the Internet usage patterns of K-12 students of Northern-Serbia. To examine the Teacher-Student-Parent triangle in detail, we also involved teachers and parents to our survey.

I. INTRODUCTION

The Internet and its use in education is not a novelty. Studies covering this field of sciences have appeared in publication since the beginning of the millennium. Nevertheless, the subject has gained renewed attention and importance, due to the exponential spread of smart phones thanks to the fact that public spaces offer a wide range of Internet access to learn and to acquire information. The entire planet has adopted a rapid pace and has become "mobile". We are accustomed to the fact that a phone, a PC, a media device can fit into a pocket, and permit quick information and source access, all of which have the potential to divert our attention to their educational exploitation [1].

Throwing a glance into the future, we can conclude that this smart gadget is going to reach more and more people, and will reform the tools of education and their content, as well [2]. However, the number of students on-line is much higher than in 2013, this fact, however, legs behind its projected potentials [3]. The statistics may not stagnate at this level, since according to CEOC [4] in the recent period; a rise of 15% has been noticeable. The appearance of the mobile Internet at affordable prices will boost the previously mentioned indicators causing a non-remission in the speed of change. The fall of price of tablets and smart phones will attract mobile technology into education that would transform traditional teaching methods into a richer peer-to-peer or 1:1 learning environment for every single student [5]. Changes in society can be grasped even now. Less and less people use the traditional functions of a mobile phone, since they prefer transferring data, pictures, listen to music, and connect to the Internet. We rely on smart phones not only this way but we also meet new people, friends, talk about the latest happenings around us and the world [6]. According to the survey of the Net Children Go Mobile, astonishingly students do sent emails; rather they use social media to transfer messages [7]. Thus, to keep contact with each other, learners tend to post or leave Instagram entries instead of telephone conversations [6].

The transformation in communication has taken an unbelievable shape and speed, unfortunately, however, only a tiny bit of educational institutions use such new technological opportunities actively, and even less number of teachers have data sharing methods in their repertoire [8], which anyway legs behind the ITC knowledge and demands of students. This is the very reason why educational systems need partial or total paradigm shift to close up. Answers have to be given to such questions as in what way will mobile phones and broadly accessible Internet infiltrate the realm of classroom activities, which are the potential focus groups to be paid extra attention to, and what effects will the technological changes have on the traditional educational system.

II. REVIEW OF LITERATURE

It seems that thanks to the new mobile technology, huge changes have occurred in our social and cultural life resembling to an entirely new technological revolution. A good example might be the Arab Spring in the beginning of 2011, which was triggered through smart phones and led to the collapse of a ruling regime [9]. According to many researchers, this revolution is going to infiltrate into the daily routine of schools.

New technologies, especially smart phones have liberated on-line and e-learning, since the beginning, static Internet connections have turned to a broadly accessible ones making classrooms and libraries mobile all the time. It does not cause a problem to our children to initiate private calls in a public space or to use the apps of their smart phones [6]. Nowadays, time seemingly wasted during a travel in a car or on a bus would only provide an opportunity to use mobile phones to connect to the Internet. Studies have shown that students not only take an active participation in the digital world but also learn how to use it, through which they learn to acquire relevant and accurate knowledge owing to new technological advancements [8].

We live in an era when the exponential rise and development of data and new knowledge pose a great challenge and difficulties to institutions, which force us to think over the global scope of teaching and learning [8]. Anyone almost anywhere can access to new levels of human relationships, experimental learning, and individual use of the curriculum. Due to immediate interactions, students have the opportunity not only to learn but also to teach, finally yet importantly, and to take up questions that would prepare them for the adulthood. Internet is used as an "up-to-date" database for sources of information and as we face new technological innovations, students will be able to acquire relevant content without any obstacles. This, however, will bring about huge challenges in developing educational and curriculum based strategies [10]. Students are given the opportunity to realize that there are different social, economical, political, and individual realities, which would all be unlocked with the help of relevant contents to shape individual thought processes, and world-view. So far, teachers, however free information flow may take this function over, have formed these in schools.

On-line media has become deeply rooted in our daily lives, irrespectively of this fact; it is still regarded as a "new medium". Analogous to this, numerous empirical studies have been focused on different public and political debates about the questions of the transition from "off-line" to "on-line" operation. A study shows that in 2010 family members used their own desktop computers to connect to the Internet (53%), while today this has considerably changed elevating the percentage to 46% of those who use laptops and 41% of those who surf the net via smart phones [6]. Constant commuters of students and workers, who are forced to move from one place to another, are more likely to use mobile technologies to access on-line information including learning material from anywhere and anytime [11]. They use application to access various contents which hints to the tendency of classrooms becoming digital. It would mean a novel approach to voice, video, and text-based learning materials. It is widely known that teachers use multimedia sources to enhance their lessons [8].

We have seen that there is indefinite number of new opportunities; however, schools have shown a considerable resistance to a rapid and bold transformation. It cannot be neglected, though, that a seemingly slow social transformation followed in its process may shift to a rational and moderate standpoint as revolutionary tensions die out [12]. Accordingly, if not in the recent future but on the long run we may expect reactions and results. Vavouula would urge the previously described processes since in his view the use of mobile phones are alone motivating, which can be easily turned to the advantage of teaching [13]. Mobile technologies permit us to process and collect students' feedback, while during a working process, which emphasises the hybrid application of technologies, we can use them as additional teaching devices [1]. In such a hybrid model, a student usually sitting passively at the back of the classroom would gain the opportunity to hypothesise, to ask for peer review, and to take notes of the problems they are working on [14].

As a pedagogue and as a private person I would express my concerns about the overwhelming power of technologies among our students and children. Nevertheless, in my view, we could use technology for educational purposes in a correct and appropriate way to enhance efficiency. We all agree that everybody has the right to access learning material regardless of his or her background and social status. Learning through smart phones change traditional concepts of learning in a way that the model of institutions and curriculum as knowledge generators would shift to the model of purposeful knowledge acquisition and motivation to learn [15]. Student will not have to wait for a class to begin, and even will not have to be at school to be able to learn. On the one hand, mobile technologies would give the opportunity to learn on a location the most suitable for him/her. Besides, students would gain the freedom to have a personal choice when it comes to learning materials found in a huge abundance. On the other, integrated mobile technologies into formal and informal education would get a chance to develop learning materials or even better to personalize the same with the help of the Internet. Educators may even hold extra curriculum study hours and organize on-line debate workshops regardless of time and place constraints. Finally, the combination of smart phones and mobile Internet has the potential to provide a rightful access to education for those who have been neglected socially or economically. Knowing this, it would be imperative to reconsider their aspects and opportunities in every region and country in the world.

III. MEASURE INSTRUMENTS AND HYPOTHESES

The role of schools has been changed in the past few years regarding the transfer of information, since the only necessary instruction to give to students is how to find relevant and valid information. It would be important to know what they do on their devices, how much time they spend on on-line entertainment and learning. In our research, we have made quantitative questionnaires of the digital learning habits and the Internet usage patterns of 223 K-12 students in Northern-Serbia. To examine the Teacher-Student-Parent triangle in detail, we also involved 30 teachers and 20 parents in our survey. On-line questionnaires were used to collect data from students, teachers, and parents. The questionnaire was available on a homepage advertised and shared in Facebook groups. Data were automatically stored in an on-line database that was later evaluated to obtain a global picture of the learning styles and the available learning tools of Z-generation students in Vojvodina.

Our hypotheses:

- Conditions for learning and teaching with the help of mobile phones in the region of Vojvodina are given.
- Regardless of parents' income, students have and use very similar devices.
- Students regularly use their mobile devices for on-line learning.
- By examining the teacher-student-parent triangle, we may state that each member has resort to the communication possibilities of Facebook.

IV. RESEARCH FINDINGS

This piece of research was conducted between 223 students, of which 108 male students have a Facebook profile (100%), while only five female students do not have a Facebook profile of the 115 participants. These five students were in the age group of 13-14 (see Table 1.).

TABLE I. THE NUMBER OF STUDENTS INVOLVED IN THE STUDY AND THE NUMBER OF THOSE WHO HAVE A FACEBOOK PROFILE

Age Group/Sex	Boys	Boys with an FB profile	Girls	Girls with an FB profile
0 -8 years	1	1	0	0
9 -10 years	1	1	1	1
11 -12 years	13	13	11	11
13 -14 years	46	46	33	28
15 -16 years	17	17	21	21
17 -18 years	30	30	49	49
Altogether	108	108	115	110

It is estimated that one third of the students use personal computers for learning and another third sit down to a laptop. Figures show that girls prefer using laptops for learning; while boys tend to do; similar tasks on a personal computer (see Table 2. Figure 1.). We also found out that tablets and phones are less used than other devices, though 38% of the participants have a tablet and 83% have a smart phone.

TABLE II. DEVICES STUDENTS USE FOR LEARNING

Age Group	Sex	PC	Laptop	Tablet	Smart Phone	Non users of devices
0 -8 years	Boys (1)	0%	100%	0%	0%	0%
	Girls (0)	0%	0%	0%	0%	0%
9 -10 years	Boys (1)	100%	0%	0%	0%	0%
	Girls (1)	0%	0%	0%	100%	0%
11 -12 years	Boys (13)	30.8%	0.0%	7.7%	7.7%	53.8%
	Girls (11)	27.3%	45.5%	0.0%	9.1%	18.2%
13 -14 years	Boys (46)	41.3%	6.5%	8.7%	13.0%	30.4%
	Girls (33)	21.2%	27.3%	27.3%	21.2%	3.0%
15 -16 years	Boys (17)	41.2%	35.3%	0.0%	5.9%	17.6%
	Girls (21)	28.6%	38.1%	9.5%	9.5%	14.3%
16 -18 years	Boys (30)	40.0%	50.0%	3.3%	6.7%	0.0%
	Girls (49)	34.7%	59.2%	0.0%	4.1%	2.0%
On average	Boys (108)	40.7%	22.2%	9.3%	5.6%	22.2%
	Girls (115)	28.7%	44.3%	6.1%	9.6%	11.3%
	Boys and Girls (223)	34.5%	33.6%	7.6%	7.6%	16.6%

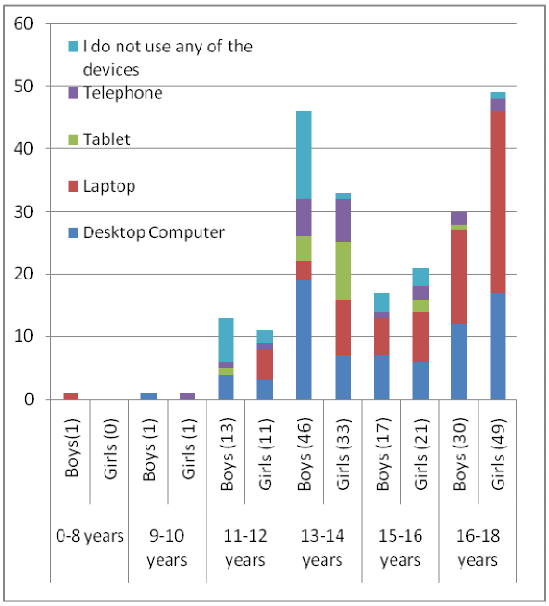

Figure 1. Devices students use for learning

Students who participated in this study are on-line on average for 5 hours a day, of which 29.02% amount to learning (see Table 3. Figure 2.). We have found no correlations between age groups, sex, and learning based Internet use.

TABLE III. STUDY OF THE AVERAGE TIME SPENT ON THE INTERNET

Age Group	Sex	Average time spent on the Internet (hours): In own room	Outside own room	Total of learning based Internet use	Total of actual learning
0 -8 years	Boys	0	0	0	0.00%
	Girls	0	0	0	0.00%
9 -10 years	Boys	4	5	4	44.44%
	Girls	3	2	2	40.00%
11 -12 years	Boys	3.15	2.08	1.77	33.84%
	Girls	2.64	2.18	1.27	26.35%
13 -14 years	Boys	2.74	2.04	1.2	25.10%
	Girls	2.97	1.76	1.52	32.14%
15 -16 years	Boys	2.94	2.35	1.24	23.44%
	Girls	3.05	2.19	1.15	21.95%
17 -18 years	Boys	2.23	2.67	1.8	36.73%
	Girls	1.98	1.65	1.12	30.85%
On average	Boys	2.87	2.01	1.41	28.89%
	Girls	2.60	2.10	1.37	29.15%

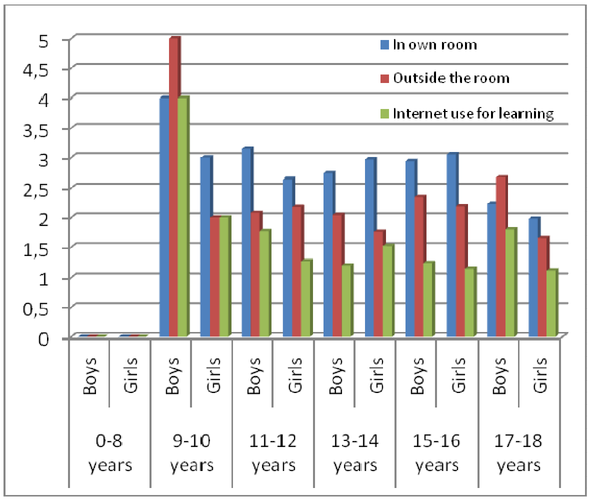

Figure 2. Study of the average time spent on the Internet

Only 23% of students do not communicated with their teachers over Facebook, while the rest of them take advantage of the opportunities provided by the social media allowing for a fast and easy communication (see Figure 3.). A slightly more than one third of the parents do not keep contact with the teachers of their children over Facebook. In teacher-parent relationship, personal meetings are considered highly important, though, in many cases Facebook provides a faster way to change information.

Part of our study focused on the correlation of family income and smart phone use in the household. We concluded that most of the students (82.2%) have a smart phone with exclusive use. (See Table 4. Figure 4.) 77.8% of students have a desktop computer, however, more than half of them (52.6%) share this device with the rest of the family members. 55.6% of learners have a laptop, of whom 21.5% share it with their close relatives. Tablets, in relation to the above-mentioned devices, seem less popular whose percentage does not go over 34.1%, and only 11.9% of them share laptops. The bases of this study was a sample of answers gathered from 135 learners, given the fact that the rest did not provide relevant information or did not know the amount of their parents' income.

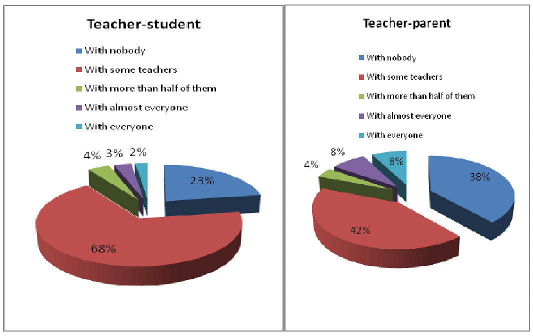

Figure 3. Communication over Facebook between teacher-student and teacher-parent

TABLE IV. DEVICES USED BY STUDENTS RELATED TO THE INCOME OF THEIR PARENTS

Income	Number of Students	Smart Phones	Tablet	Laptop	Personal Computer
0 – 20.000	14	85.7%	28.6%	28.6%	78.6%
20.000 – 40.000	35	74.3%	42.9%	62.9%	74.3%
40.000 – 60.000	41	82.9%	31.7%	51.2%	78.0%
60.000 – 80.000	22	81.8%	31.8%	54.5%	86.4%
80.000 – 100.000	12	91.7%	8.3%	75.0%	66.7%
More than 100.000	11	90.9%	54.5%	63.6%	81.8%
On average/ altogether	135	82.2%	34.1%	55.6%	77.8%

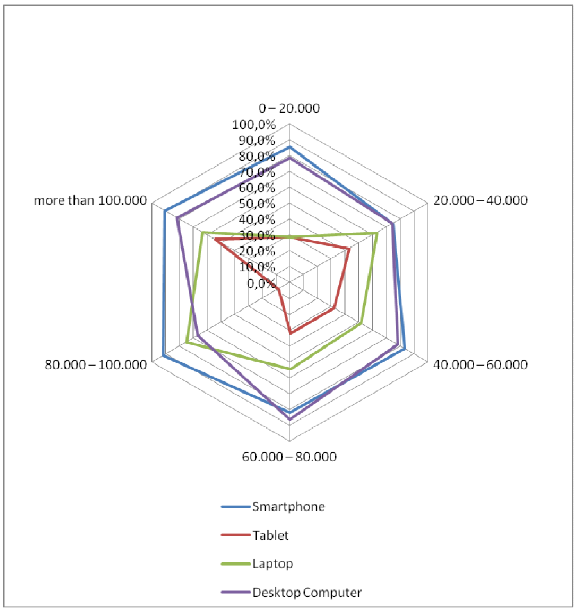

Figure 4. Devices used by students related to the income of their parents

V. INTERPRETATION OF THE FINDINGS, CONCLUSION

Our first hypothesis, namely that circumstances for mobile use with the aim of learning and teaching seem valid and proven, since 82.2% of students already have a smart phone in their own possession. This number, though, may seem higher than in the case of personal computers, which are used shared with household members.

Our second hypothesis seems also plausible, since studies show that there is no correlation between family income and students' smart phone possession, a tendency that is true for tablets, as well. Furthermore, it should be mentioned that laptop possession is considerably lower in families with the lowest income.

Our third hypothesis has not been met because students prefer desktop computers and laptops to mobile phones, even though they have at least one of the latter.

Our fourth hypothesis may be considered valid since 77% of students use Facebook applications to communicate with their teachers. Parents, however, take the least advantages of the services provided by the social media to communicate with the teachers of their children. This number rises to only 62%. These figures, however, cannot be considered low, if parents prefer personal meetings with teachers, or at least talking over the phone.

In conclusion, it can be stated that circumstances for M-learning have been given even in such a poor region of Europe as Vojvodina, which allows for the use of their smart phones for learning purposes. In order to revolutionize learning, it is highly needed to undergo a shift in attitudes toward new technologies among teachers; nonetheless, Serbia should adopt a regulation that would allow smart phone use in education, a development that has already been widely accepted in western countries. Such technological innovation would not generate extra financial spending for schools, since students already use smart phones, and could easily adapt themselves to new circumstances reducing the need to buy new computers and learning material.

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DEVELOPMENT AND EVALUATION OF VIDEO GAME FOR LEARNING CAPABILITIES IMPROVEMENT OF ADHD CHILDREN

S. Koceski, N. Koceska
Faculty of Computer Science, University Goce Delcev - Stip, Stip, Republic of Macedonia
{saso.koceski, natasa.koceska}@ugd.edu.mk

Abstract – Persistent and severe impairment of psychological development resulting from a high level of inattentive, restless and impulsive behavior is classified according to the fourth Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) as attention-deficit/hyperactivity disorder (ADHD) and according to the Tenth International Classification of Diseases (ICD-10) as hyperkinetic disorder (HD). ADHD is associated with poor grades, poor reading and math standardized test scores, and increased grade retention in schoolchildren.

Besides medical treatment of these children, biofeedback is recognized as an internationally recognized alternative therapy for ADHD children nowadays. Moreover, there are many studies regarding the influence of the video games on ADHD children. Although in many cases the opinions and findings are contradictory all of them are concluding that ADHD children could benefit from properly designed video games that are played according to a specific protocol and under supervision of teachers or parents.

This paper presents a developed video game that aims at helping ADHD in improving their learning capacities. It consists of several different modules and levels. The design and development of the game as well as its architecture are presented in this paper. The game has been experimentally evaluated on ADHD children. The results of the evaluation are also presented in the paper and conclusions are drawn.

I. INTRODUCTION

Among all neurobehavioral disorders, Attention Deficit Hyperactivity Disorder (ADHD) is the most frequent one diagnosed in childhood. There is estimation that it is affecting 5.29% of children worldwide [1]. Childhood ADHD has been studied intensively in the last decade. One very comprehensive theory focusing on executive functions (EFs), such as working memory (WM), Visuo-spatial WM, response inhibition, and temporal processing, is developed by Barkley and it assumes that self-regulation deficits are at the core of the ADHD syndrome.

Another theoretical approach to ADHD claims that low level of reinforcement and motivation, have huge impact on performance deficit in ADHD children.

Various studies have shown that computerization of tasks can have positive impact on increasing ADHD children's interest and motivation. This is mainly because computer programs have clearly defined protocols and scenarios, evidenced goals and objectives, and immediate feedback on the performed actions. Moreover, if the computer programs are created in the form of interactive video games could attract the children's attention, concentrate for longer period, and behave less impulsively.

In contrary, the literature evidences cases in which the effect of video games has negative influence on children [2-4]. The main drawback of these studies is that they are not considering the specificity of the video games. Most of them did not even specifically examine the video games and their details, but are classifying them as a subset of television or Internet use. One extensively studied area is the content of video games and their relationship to subsequent aggressive behavior in children [5, 6]. Other case reports have documented correlation between video games with lower academic achievements [7]. However, the latest should be analyzed very carefully, because the main reason for the lower academic performances might not be caused by the video games themselves, but it might be a result of a very long time spent playing video games instead of reading and curriculum-related academic study.

Considering the previous, one may conclude that carefully designed and developed video games that are played according to a specific protocol and under supervision of teachers or parents could be beneficial.

Therefore, ADHD children might benefit from video games designed in such a way that their gameplay gradually stimulates the players to perform more accurate and precise actions to make accurate and more demanding decisions and actions at higher levels of the game i.e. at higher speeds. Consequently, it should increase working memory spans, it can provide pro-social training and can offer positive neurological changes in the brain system.

This paper presents a developed video game that aims at helping ADHD in improving their learning capacities. It consists of several different modules and levels. The design and development of the game as well as its architecture are presented in this paper. The game has been experimentally evaluated on ADHD children. The results of the evaluation are also presented in the paper and conclusions are drawn.

II. RELATED WORK

In general all computer video games related to ADHD children could be classified into two big categories i.e. diagnosis and evaluation games and treatment/therapeutic games. Second group is the main subject of interest in our study. The first therapeutic videogame was developed by Pope and Bogart in 1996, and is a modification of software developed by NASA for the training of pilots, based on the progressive adaptation of a computer programme to user attention levels [8].

Latter on in 2001, Pope and Palsson have developed a methodology, which was combining commercial off-the-shelf videogames with the use of EEG measurements. It was aimed as an intervention tool for the improvement of ADHD children [9].

Commercially available videogame “The Journey to Wild Divine” is a simulation in which virtual characters in the 3D virtual world are controlled through biofeedback. Game control is based on relaxation techniques, which are very useful in the regulation or monitoring of hyperactivity and impulsivity in children and adolescents with ADHD [10].

Statements et al. [11] have conducted a comprehensive study in which ADHD children were involved in a virtual helicopter game. In this game, the children were given different tasks to control the helicopter using MRI images which were used to measure the activity on certain areas of the brain.

3D video game Self City [12] was oriented towards the improvement of social skills in adolescents diagnosed with ADHD and/or Pervasive Developmental Disorder. In this game, the players were faced and challenged to cope with several different situations.

Personal Investigator (PI) is a 3D game specially designed to help adolescents with disorders with Focused Solution Therapies—SFT and therapy games. It was initially tested with 4 adolescents with positive results [15].

Play Mancer is another serious videogame developed for therapy of various disorders but also including ADHD [13,14].

Besides these, various other commercial videogames were adapted to ADHD therapy program such as Robomemo (CogMed, Stockholm, Sweden) [16], the Supermarket Game and CyberCruiser which have been tested with over 50 users.

De La Guia et al. [17] present collaborative games developed in a novel multi-device environment applying the distributed user interface paradigm together with tangible user interfaces (TUIs). The aim of this game is to improve memory and attention in children with ADHD.

Pier et al. [18] developed computerized executive functioning training with game elements aimed at enhancing self-control. They have experimented and evaluated the transfer of training effects to daily life, and enhancing motivation through more gaming elements. The presented results in their study are promising.

Finke et al. [19] have investigated the attitudes and opinions of parents having children with ADHD and ASD disorders, which are playing various video games. They concluded that parents indicate that video game play was positive for their children with ASD, particularly if they believed the games were having a positive impact on their child's development.

Brezinka [20] has investigated the influence of the game Treasure Hunt that was developed to support cognitive behavior therapy with children who come into treatment for various mental health problems. She is mentioning the how important is to know the opinion of therapists on the impact of the game on treatment success. The 42 therapists treating the 218 children reported that the game was helpful and it was also used as reinforcement, enhanced child motivation, structured therapy sessions and strengthened the therapeutic relationship with the child.

Ferguson et al. [21] in their study are examining the possibilities of applying the video games (Wii Sports) to develop social skills i.e. “good sportsmanship” in children diagnosed with ADHD. They are concluding that video-game technology could be part of social skills intervention programs.

III. Video Game Description

In this study, an interactive closed loop game was created. The game was based on Microsoft Kinect (Figure 1) sensor, which is providing the input to the game. The main components are the RGB camera, depth sensor and microphone array. The depth sensor combines an IR laser projector with a monochrome CMOS sensor to get 3D video data. Besides these, there is a motor to tilt the sensor array up and down for the best view of the scene, and an accelerometer to sense position.

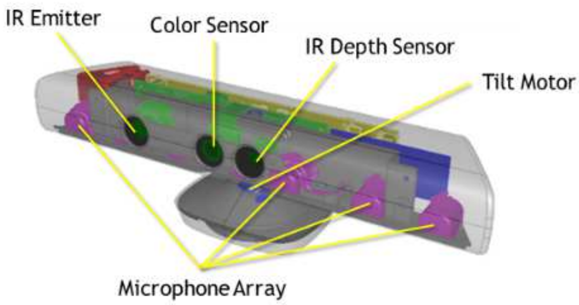

Fig.1. Microsoft Kinect Structure

The architecture of the game developed is presented in Figure 2.

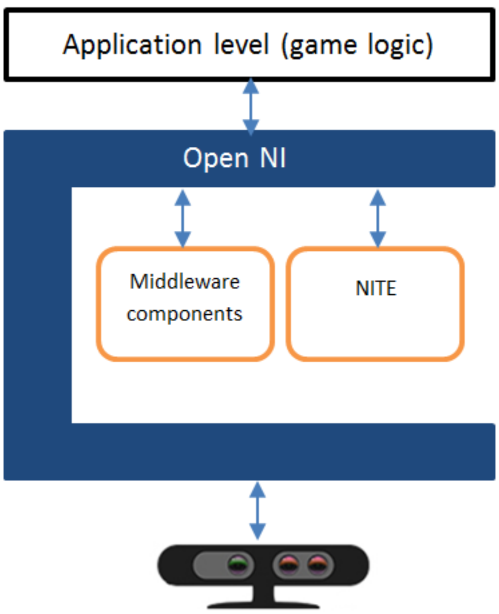

Fig.2. Application Architecture

The game is played in a way that the child is placed in front of a big screen (can be TV set or projector) and in front of the Kinect device. Typical game set is depicted in Fig. 3. The application using the device input is capable to detect the child’s body and characteristic points. All the characteristic points that could be detected are presented in Fig. 4.

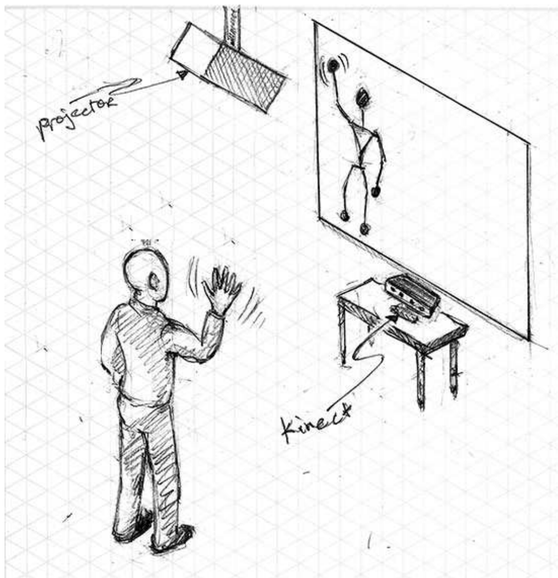

Fig.3. Typical game set

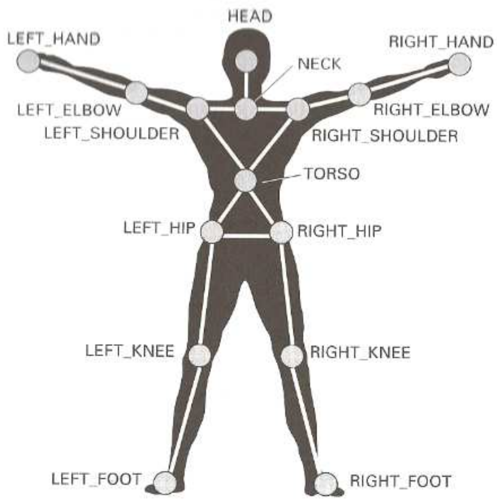

Fig.4. Key points on human body that could be detected and used at application level

By detecting the body’s key points the application is capable to detect the actions the player performs and track them. Moreover, some of those points i.e. their position could be used as an input to the game (i.e. use them as a mouse pointer).

This way the child through its movements can command the game and interact with the virtual 3D world that is displayed on the screen in front of him.

In our study, the game is composed of two different modules. One of them was aimed at stimulating the child to perform more accurate and precise actions at higher at higher speeds of the game. The second module aims at helping the child to train his working memory spans and spatial orientation.

In the first module the child is controlling (using his hands) one fish which is swimming in a water tunnel. The aim is to reach the end of the tunnel. The problems the child is facing on its way along the tunnel are obstacles showing randomly that should be avoided. When the obstacle appeared on the screen, an audio stimulus is also presented to the child as an additional input. Moreover, the swimming speed is increasing as the game proceeds i.e. the fish is going towards the end of the tunnel, and the tunnel is getting narrower.

The second module is presenting matrix of various number of boxes hiding pairs of different images. Some of the images are very similar to each other. The player in each move is opening two of them and tries to pair the exact images. As the game progresses, the number of boxes is augmented.

Upon each well-completed move in both modules, the player is awarded by collecting golden coins, which at the end are compensated with real fruits.

IV. Evaluation and Results

Ten children between 6 and 12 years (6 male and 6 female) diagnosed with ADHD, three teachers from different primary schools attended by these children and four therapists were involved in the evaluation study.

The evaluation was performed in three phases. The first one is regarding explanation of the user interface to the children and calibration of the system. In the second phase the children were given a practicing session. The third phase is regarding the evaluation itself. The evaluation phase was lasting for four weeks. During this period, each of the children was playing the game for 35 minutes three times a week under supervision of the therapist. For each gameplay, therapists were annotating the impressions of the children collected by an interviewing methodology. During the evaluation period, also the teachers were conducting a special diary regarding the children's achievements at school and their behavior.

At the end of the evaluation period, both teachers and therapists' opinions were collected. All of them have reported important progress. Namely, working memory has been significantly increased, number of forgotten tasks at school has been significantly diminished, and time for which the children stayed calm and focused on their tasks has been almost doubled after the evaluation period.

V. Conclusion

This paper presents a developed video game that aims at helping ADHD in improving their learning capacities. It consists of several different modules and levels. The design and development of the game as well as its architecture are presented in this paper. The game has been experimentally evaluated on ADHD children. The results of the evaluation are promising and are showing improvements of the children performances.

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SOCIAL NETWORKS AND THEIR INFLUENCE ON EDUCATION

IMPACT AND THE USE OF SOCIAL NETWORKS IN HIGHER EDUCATION

N. Aleksić, A. Mišković, N. Banković
Higher Technical School of Professional Studies/ Computing Engineering, Kragujevac, Republic of Serbia
ingnaca78@yahoo.com; sasafij@hotmail.com; nevenabankovic@gmail.com

Abstract - They were built only a few years ago and have become integral to our lives. In fact, social networks have permeated all aspects of our lives. In recent years, social networks are very popular among young people. Studies have shown that using them at all times and for different activities, and various authors investigated the possibility of using the Internet and social networking for educational purposes. As part of this, the paper presents the results of research and Facebook Internet habits of students of Technical School of Professional Studies in Kragujevac. Explored what and how students are doing on the Internet and Facebook. Special emphasis was placed on Facebook as is currently the most popular social network, and explored whether students use Facebook, as well as for educational purposes, as we have been thinking about the possibilities and importance of applying social media to communicate with staff and their impact on the quality of the education process.

I. INTRODUCTION

The concept of social networks involves advanced information and communication technologies (ICT), and in recent years we have witnessed a real revolution in the development of these technologies. ICT is beginning to intensive use in teaching, schools and universities to create their website, create profiles on social networks.

To access social networks need to know the basics of using ICT and Internet access required. When you register on a social network, a fundamental step is to make your own profile, during which the temperature of the user for personal information (name, date of birth, gender, educational background ...).

The fact is that the more time we spend in front of a computer, but in the company of our family and friends. The question is whether we are dependent on the social networks and that they are actually the social network a logical result of our IT development, as well as an inevitable phenomenon that maintains a state in which our society is.

The undoubted fact is that Facebook is currently the leading social networking site. Founded in as many social network sites by students who tried out their projects with the help of his fellow students.

II. CRITICAL REVIEW OF THE SOCIAL NETWORKS

Social networks have in recent years the phenomenon that swept the whole world, and it's almost hard to describe the structure of users of social networks - are used by both men and women and young and old, and in the private and business purposes. And what are really social networks?

Social networks are online services, mostly free, giving users a variety of ways and types of communication with other users. Social networks have allowed just that - communicate - and now the most popular form of internet communication. The structure of social networks made of individuals who are called "nodes". Nodes are the individual actors within the networks, and ties are the relations between the actors. It could be a number of different connections between nodes. Research in academia has shown that social networks operate on many levels, starting from: friendship, family ties, ideas, common interests, trust, knowledge and prestige.

To the world's Internet networks are certainly Facebook, Twitter and LinkedIn, where the public is most familiar with the highest number of Facebook users.

Also in everyday story of social networks can be assumed that they do not have the same negative side. However, as the use of social networks brings some good sides has its negative side.

Among the benefits of social networks are:

- Free access
- Optional access
- The possibility of acquiring new friends
- Computer training
- Maintaining contacts
- Monitoring of current issues
- Advertising

Among the disadvantages of social networks are:

- Lack of privacy
- The possibility of false identity of
- The possibility of addiction
- Cyber violence
- Stalking
- The possibility of phishing attacks
- Disregard for direct communication

A. *Types of social networks*

Social networks can be divided into seven major categories: network for social networking, multimedia sharing networks, informative, professional, educational, scientific, related to trustworthy the area [1].

- *Social connections*

It is certain that social networks are the best way to connect with family members, friends, or people who are distant from us. Some of these social networks are Facebook, Twitter, Google +, and MySpace with the fact that in recent times, indicating that the old favorites such as MySpace no longer have any effect [2].

- *Deljenje multimedija*

This type of network allows you to share videos, photos, sounds and other content on the Web. The most famous social networks of this type are: YouTube, Instagram, Picasa ...

- *Information*

They are made to facilitate people search for solutions to everyday problems and getting najrlazičitijih data and information. These portals provide a wealth of data that we can be of great help. Some of them are; SuperGreenMe ...

- *Professional*

They are designed to provide an opportunity for improvement in some area. Nekeod them have forums where professionals can connect, share experiences and to identify a common interest. These are; LinkedIn, Classroom 2.0 ...

- *Educational*

Places where students and teachers work together on academic projects, enabling easy communication between students and teachers and today have become increasingly popular in the school systems. An example of this type of social networking sites are as follows: The Student Room, ePals and eLearners.

- *Scientific*

These include social networking sites where scientists can share their research with other scientists and to gain insight into their results. Some of them are: Academia.edu and Collaborative Research.

- *Time for a specific area*

One of the main reasons why people use the internet is to search for specific occupations or their personal hobbies. Users on these pages reveal the whole group of people who think alike and share the same passion for a hobby. Such networks are: Oh My Bloom and Sports Shouting.

B. *Social networks in education*

- *Facebook*

Currently, the number of users the most used social network is Facebook. The idea of Facebook is through the Internet and in a very simple way to connect people who already know each other in real life.

Facebook is characterized by a number of applications available to users with registered Profília. Facebook users have a wide range of tools that can be used. For example, users can set up an unlimited number of photos, contact lists only search e-mail account, through which they can find others who have Facebook profiles. Through the applications that users can use, can enable the availability of its information through these tools. It can also be set when the user can find when searching and who is not. Users who put content on their profile to be published in the "News Feed" -u, determine who can see the content, so you may be limited to certain sets of people to see this content.

Finally we can say that Facebook has become a great platform, which is every day more and more wider and brings the full Internet as we know it to a new width.

- *Facebook in Education*

Given that represents one of the most popular social network in the world, educational institutions have begun to use it for the purposes of education. Realizing that the students most of their free time on the internet, they decided to modernize and approach the material in an interesting way. Created a number of applications, profiles, fan pages, groups, through which students with each other and with their teachers to communicate, share ideas, opinions, experiences, etc.

Here we present the 5 best rated applications, which will help you in learning:

1. Books iRead: Share with others the book you are reading and see what they think about it;
2. Until Research 4 Me: This application makes it easy to gather information using the thesis statement, instructions and much more;
3. Flashcards: With this application you can create to help in learning;
4. Wikiseek Search: Use this tool to locate research with Wikipedia articles via Facebook - a;
5. Skool Pool: Gather information about the schools through Facebook - and.

C. *Analysis Research*

As is currently the best known and most widely accepted social network Facebook, the goal of the study was to investigate, using the students Facebook, as well as for educational purposes, and any opinions on the possibilities and importance of applying social media to communicate with the teaching staff and their impact on the quality of the education process.

Another reason to be found in a series of research about Facebook in education is one fact from personal experience.

It happened that the information posted on the Facebook profile of only 7-8 hours before the date of the meeting made a better attendance of the meeting but the information posted on the official website of the faculty for 24 hours prior to the specified term (a meeting was scheduled at 8:00 am).

Empirical research was conducted during the winter semester of 2015 among students of all years of the Higher Technical School of Professional Studies in Kragujevac.

Participation in the survey was voluntary and anonymous, and included 173 randomly selected students, out of which is retained for further processing 157 questionnaires.

The used questionnaire contained questions about the gender and age of computer usage (how often, what activities, ...), knowledge of social networks (which the network used, how often, what they are working on, ..) as well as a combination of Facebook and the educational process (I use it for educational purposes, and what they think about it).

D. *Survey*

The analysis included 157 students and based on their responses showed the following.

TABLE 1. CUSTOMER ANALYSIS BY AGE IN SERBIA [3]

Year	Representation
13 – 15	10%
16 – 17	10%
18 -24	31%
25 – 34	28%
35 – 44	13%
45 – 54	5%
55 – 64	2%
65+	2%

TABLE 2. DISTRIBUTION OF USERS BY GENDER [4]

Male population	*Female* ***population***
51%	49%

Of the 1.4 million registered users, men make up 51 women 49%. Young people aged 18-24 years represent 31% of users Facebook social network.

Internet is mainly used by people with secondary education or gymnasium (23%) and higher education (29%). Social Network consists of 96% of students with access to the Internet.

TABLE 3.SVRHA PUBLICATION OF PHOTOS AND VIDEO CONTENT ON SOCIAL NETWORKS IN SERBIA

The purpose of publishing content	***Representation***
Personal	32%
Educational	5%
Business	19%
Commercial	8%
Entertainment	36%

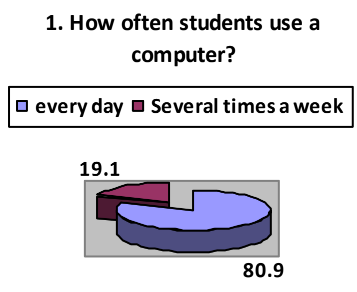
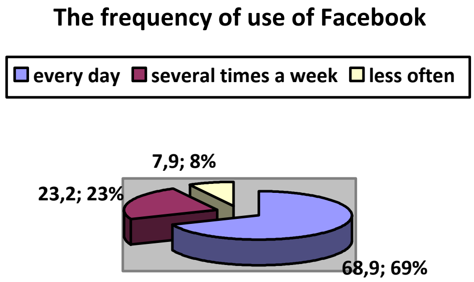


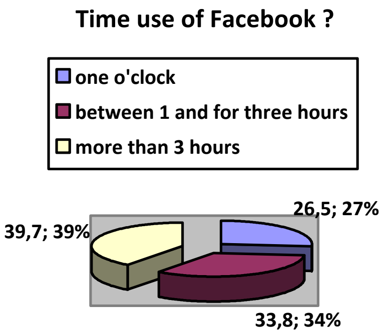
Figure 1. How often students use a computer?

As the purpose of the use of computers significantly more respondents cited entertainment (138; 87.9%), while the other primary reason for learning. Since the program (application) that students most commonly used on the computer are various Internet browsers (Internet Explorer, Mozilla Firefox, Google Chrome, Opera, ...) and Mocrosoft Office package, with an emphasis on Word, Excel and PowerPoint, while only a handful of students cited and Access. It is highly significant response represented using Facebook (provided it is over 70% of respondents).

Furthermore, students who said they were actively used Facebook, and asked to respond to questions about the frequency of the use of Facebook, the time you spend on it every day, the primary reason for its use and the activities they usually do.



Of these 104 students who use Facebook every day the question is how often?



•*Areas of use of social networks in Serbia*

TABLE 4. USE OF SOCIAL NETWORKS

The purpose of using social networks	*Representation*
Search and retrieval	20%
Education	7%
Keeping in touch	29%
Organization and planning social events	17%
advertising	20%
Other	7%

These results should be taken with caution, because if you remember the primary objective of the development of Facebook then the question is how many contacts with people in the vicinity of live and with which you often associate should be maintained in the virtual world. Another reason most commonly used is to connect with old contacts, and then followed to connect with new contacts which belongs to the maintenance of contacts 29%, and search and retrieval 20%. Organization and planning of social events is the reason the use of Facebook for 17% of students. Because education Facebook uses only 7% of students, and for the promotion of only 20% of them. Other students have stated that the reasons for their use other, but did not specify which. It is interesting to note that very few students, the reasons cited for the education. As far as education and can be understood that it is not the reason for the use of Facebook, because students probably are not familiar with these options on Facebook.

What attitudes do students have about the possibilities of using Facebook in education, according to the results shown in Table 2. The views expressed by all students, their 157.

TABLE 5. STUDENTS' OPINIONS ABOUT THE POSSIBILITY OF USING FACEBOOK WHILE STUDYING

	Da	**Ne**
It would be good if every college has a profile on FB	75,7 %	24,3
Facebook could be used as an aid to learning	66,9	33,1
It is good to exchange information related to college at FB	69,8	30,2
It is good to exchange teaching materials related to the Faculty on Facebook	72,4	27,6
Facebook može doprineti poboljšanju iskustva studiranja	70,1	29,9

From the results in Table 2 it is evident that students have a positive opinion about Facebook in the educational process. So ¾ of the students thought it would be good to each faculty has its own Facebook profile on which to publish news and events. Slightly less than 70% of students believe that Facebook could be used as an aid in learning, but they are not required to specify ways of using Facebook for educational purposes. What are the other results have concluded that students see Facebook as a commercial for sharing information and teaching materials, receiving different information from the faculty and the like.

In general the results in Table 2 or the opinion of students about the possibilities of application of Facebook in higher education shows that about ¾ believes that it would be good and would significantly strengthen the communication process, improve the experience of studying, and with it significantly contributed to the quality of the educational process.

E. Safety and security on social networks

All social networks are subject to attacks and continually invests in the safety of the composition. Facebook as the most popular among social networks have been fighting the problem of safety and has developed the composition of Facebook Immunity System that is used for checking the content that is published by users.

Regardless of whether they are beginners or experienced users, they are all susceptible to data corruption, and can become victims of failure drštvenih networks. People often refuse to use social networks, because they believe it would endanger their privacy.

It is possible to profile thefc and malicious use of credibilitj bj bringing false representation [5].

The problem of prevention of unwanted messages that are usually related to advertising nerelaventnog product (spam) Facebook solve with the help of Facebook Immunity System (FIS). Studies have shown a high courtesy of the composition, and spam on the network considers 1% of the content.

III. CONCLUSION

Results of the study are interesting and open up a range of possibilities for future research. It turned out that students are fairly computer users and that, in future research was interesting to explore in more detail all of their activities on the computer. As Facebook users, students are very active, but their responses indicate that the use of Facebook at face value, or use it primarily for fun and do not take advantage of other opportunities that significantly affect the possibilities of expanding knowledge and of learning.

Very few students noted that does not use Facebook and today would likely be very difficult to compare their views on the implementation of Facebook during the education with attitudes of students who use it.

That is another interesting point for future research the attitudes and opinions of teachers on social networks and their activities on social networks.

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USE AND FREQUENCY OF THE INTERNET AND SOCIAL NETWORKS IN PRIMARY SCHOOL

D. Gagović
University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
dusangagovic@gmail.com

Abstract - This paper presents the results of research conducted in the elementary school "Dositej Obradovic" Smederevo, in order to get familiar with using the Internet and Facebook among students in higher grades of elementary school. Therefore, the aim of the research was that the teachers and community members first learn about the habits of children and the use of the Internet and social networks, as well as threats and pitfalls that children may face using a global social network. The results showed that the vast majority of students use the Internet and Facebook, but it is mostly used for entertainment and activities on popular social networks. A small number of students pleaded use the Internet for educational purposes. It is necessary to carry out education, students, and parents about potential dangers in the use of the Internet, particularly child abuse on the social networks. Every child, regardless of age, should have at least some previous knowledge of Internet threats and how to avoid. It is the task of teachers to the information, which were reached based on the research, transformed into knowledge that will transfer students and their parents in order to protect children during their stay on the Internet.

I. INTRODUCTION

The Internet is the entry port in the people's lives and occupied an important place in everyday life of the individual. The Internet provides many opportunities, facilitates the search for a large number of different information and saves time. Neither school has not bypassed, which is another aspect of modernization and improvement of education. The age limit at which children begin to use computers all the lower and often happens to children to be computer literate than their parents. The popularity of the Internet as a relatively new medium, increases progressively taking into account the opportunities offered in the fields of entertainment and socialization. The illusion that the user is anonymous and protected, as well as seemingly limitless freedom it offers, the properties of the medium, and as such make it ideal attractive for the youngest audience. It is estimated that the Internet uses about 1.2 billion people or about 18% of the world population. Of these, half aged 5-18 years. Only a small number of children recognize the opportunities for education and information that the Internet offers.

The highest number of surveys carried out [5-8] indicates that young people are starting to use the Internet very early, still pre - school age, and mainly use it for fun (play games, listen and download music, movies, video clips, pictures, etc.). They are very popular social networking and dating sites MySpace and Facebook. The data indicate that 38% of children aged 9-12 years have a profile on one of the social networks, despite the age limit of at least 13 years. It is estimated that Facebook, despite the statutory retirement age to use social nets, currently has about 7.5 million users under the age of 13 years and 5 million under the age of 10 years. Facebook, according to the latest data, there are about 400 million users and is now one of the most visited sites in the world. According to a study carried out by the AdriaTalk, Serbia is a leader in the region with over 2 million Facebook users. According to estimates by the agency Nielsen, in May 2009, children aged two to 11 years accounted for 9,5 percent of all regular Internet users in the United States. The number of children using the Internet increased by 18% in the last five years, while the number of adult Internet users in the same period increased by only 10%. The time children spend on the Internet increased from approximately seven hours in May 2004 to over 11 hours in May 2009, which represents a growth rate of 63%. Results show that boys spend 7% more time online than girls, but for the time they spend on the Internet girls visit 9% more sites [12].

As the majority of citizens are, still not sufficiently informed about the importance of safe use of the Internet among a large number of parents and still there is a belief that children are safest in the home, at the computer. However, there are frequent cases of Internet abuse such as misrepresentation or encouraging bullying by spreading content that ridicules or endanger someone's safety or dignity. It is a frightening fact that 57% of children on the Internet see a kind of pornography. Violence on the Internet is increasingly common, and in the environment of virtual communication at first glance it seems that the law, technology, schools and parents can do very little to stop it. In the area of legislation, the European Commission has since 2006 adopted a number of legislative directives aimed at reducing the negative impact of the Internet on children and youth, or a reduction in its uncontrolled and aimless use [9].

Bearing all this in mind, the research was done in order to be acquainted with the habits in using the Internet and Facebook, students of elementary school "Dositej Obradovic"- Smederevo, to educational and school staff, if necessary, act pre-emptively in directing students to make the best maximum advantage Internet in the educational process of cognition.

II. Methodology

The aim of this study was to determine the manner and frequency of use of the Internet and social networks (Facebook), while students in higher grades of elementary school.

It was presumed that students spend too much time on the Internet and social networks, not caring for the neglect of their everyday lives and for their safety.

The method used in this paper is descriptive method because it was necessary to know how and for what purposes students use the Internet and social networks in the present, and applied research technique was the survey by questionnaire [1].

A questionnaire containing 30 questions related to the Internet and Facebook, which are defined so that they are clear and understandable. The questions were designed so that the student had the opportunity to choose one of two possible answers offered or one or more answers from multiple-choice answers.

The structure of the survey was as follows:

- Questions 1-3 are related to sex and grade students, if the student has a computer and is connected to the Internet.
- Questions 4-15 were linked to the use of the Internet.
- Questions 16-31 were directed to social networks, ie. Sign up because it was assumed that the vast majority of almost 100% of students have Facebook profile.
- The last question was whether students are concerned about your privacy on Facebook.

The teaching staff of the school, the subjects Informatics and Computing, implemented the survey.

Surveyed 189 students from fifth to eighth grade who on that day had the time of Informatics and Computing. 29,1% were students of the 5th grade, 27,5% of 6th grade students, 12,7% of students grade 7, grade 8 students 30,7 (Figure 1).

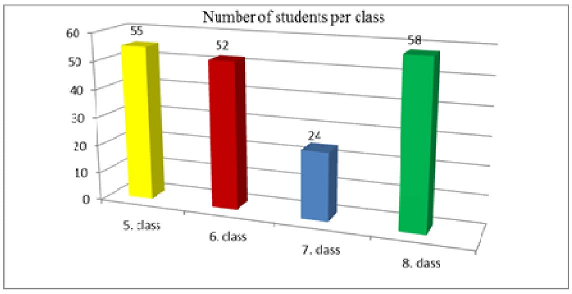

Figure 1. Number of surveyed students per class

The share of respondents by sex was almost equal, girls 48.2% and boys 51.8%.

III. Research Results

The survey results showed that almost all of the surveyed students a computer 98% and 93% of respondents have Internet access. It is assumed that children who do not have a computer come from families with modest financial status.

A. Use of the Internet in elementary school "Dositej Obradovic" - Smederevo

The highest percentage of 99% of the 189 students surveyed said they use the Internet, and 1% that is not used (except in school when teaching unit requires the use of the Internet). 91% of surveyed students most commonly used Internet at home, at school 4%, 2% at a friend or relative, and 3% in Internet clubs.

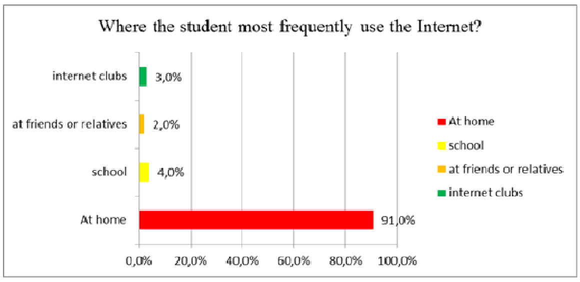

Figure 2. Place the use of the Internet

Looking at the frequency of Internet usage shows that 83% of students use the Internet every day, 15% uses the Internet several times a week, while the remaining 2% of students use the Internet once or twice a month or even less frequently

(Figure 3). These results show that a growing number of children who use the Internet the main contents of free time. A large amount of time children spend on the Internet does not leave them much time to socialize and play with their peers, talk with family members, practicing sports, etc., which may adversely affect their overall development.

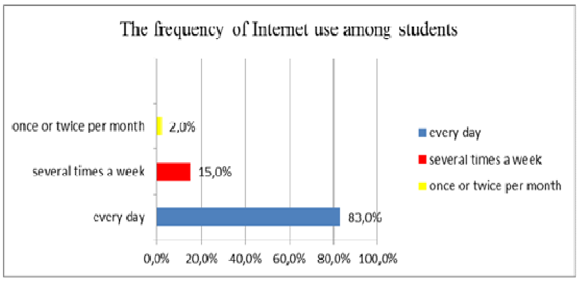

Figure 3. Frequency of Internet use among students

The highest percentage of students on the Internet during the day spend more than 60 minutes in 71% of 30-60 minutes 23%, less than 30 minutes 5%, do not spend time on the Internet 1%. This tells us that children are increasingly devoting their time access i.e. His use of neglecting its obligations to the school, family, sports and other activities (Figure 4).

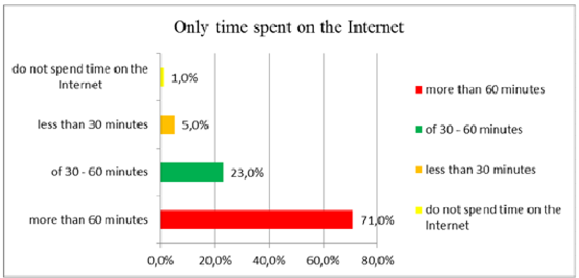

Figure 4. Time spent on the Internet

For questions related to the appearance on the Internet, students have responded worrying. When asked whether playing games as much as 74% answered that they play games every or nearly every day, while 26% never or sometimes. Students rarely use it for solving homework (82% never or sometimes) although the Internet may find useful items and tools for solving these tasks. 18% of respondents said the home is set up for the solution of using the Internet every or almost every day. 57% never or sometimes uses e-mails, while 43% use e-mail almost every day. Everyday chatting at 44% and sometimes 56%. It is worrying that 71% of students it almost never searched for schoolwork, while only 29% do so almost every day. The survey we are almost sure that students use the Internet only for fun (listening to music, playing games, downloading music, watching and downloading movies and other applications), and in a small percentage use it for educational purposes. Table No. 1 shows the percentages of responses to questions about phenomena on the Internet and indicated (shaded and in bold) percentages to think about and open debate. From the attached table shows that students do not use the Internet, as it should be.

TABLE 1. THE PHENOMENA RELATED TO THE INTERNET

QUESTION	interviewees %	
	Sometimes or never	Every or almost every day
You play games?	26	**74**
Do you do your homework by computer?	**82**	18
You use e–mail?	**57**	43
Chatting?	56	**44**
Browse Internet for fun (such as watching videos, for example. Youtube)?	16	**84**
You take music, movies , games or applications from the Internet?	33	**67**
Participate in forums on the Internet?	85	15
Browse Internet for school assignments?	**71**	29

B. *Use of Facebook in elementary school "Dositej Obradovic" - Smederevo*

When asked whether they have a profile on a social network, 95% of students responded that they have, and 5% do not. We note that most of the students use Facebook 95%, while 33% of students in addition Facebook has another social network is the second part of the survey devoted to Facebook as the most frequently attended by a social network (Figure 5).

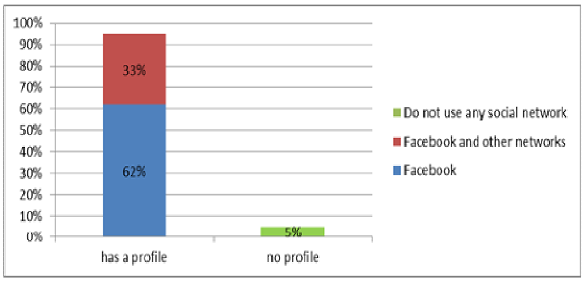

Figure 5. Possession of profiles on social networks

Facebook profile, 41% of students used more than 2 years, 46% 1-2 years, 6-12 months, 7%, 6% 1-6 months, while 6% have a profile but it is not used. The results showed that students generally open their profile when they go into the fifth or sixth grade.

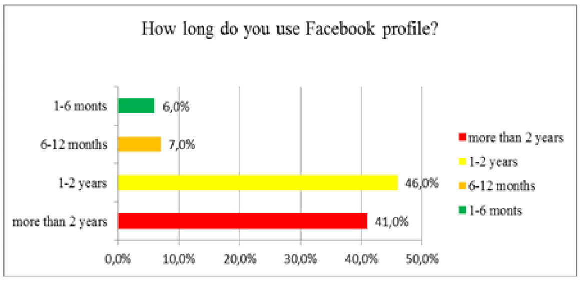

Figure 6. Opening profile on Facebook

Studies have shown that the majority of students for others goes several times a day, 57%, 25% once a day, several times a week, 11% once a week, 3%, less than once a week 4% (Figure 7). This study showed that more than half of the students their time mainly carried out on Facebook, which leads to our assumption that students spend a lot of time on the Internet and Facebook. Students generally spend 3 or more hours 38% on Facebook is worrying, as this neglect their obligations and leisure activities. Two hours 26% of students performed at Facebook, one hour 16%, 15% for half an hour, 15 minutes 9%.

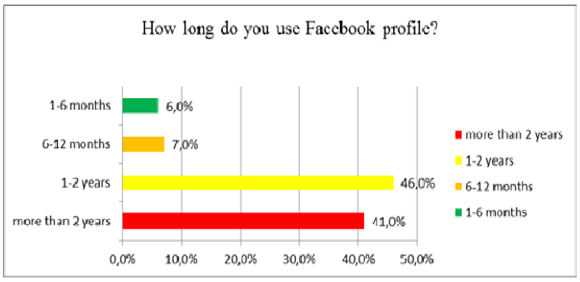

Figure 7. Time use of Facebook

On the question of the purpose for the students used Facebook in the vast majority responded that they use it to communicate with friends through chatting or messaging 73%, browse photos and videos 8%, play games and use applications 12%, meet new friends 2%, Learning 1%, 4% something else. By how many hours on weekdays using Facebook 37% of students responded to 21 hours, and 22 hours 18% up to 23 hours 17% to 24% 6 hours , sometimes after midnight 23%. The question of whether the use of Facebook influence on the performance of daily activities, students have responded as follows: never had anything like that happened 42 %, yes, but I rarely dogođa 38%, that often is this happening to 20% (Figure 8). This shows that students or not to recognize or not to see excessive use of Facebook badly affect the performance of daily duties.

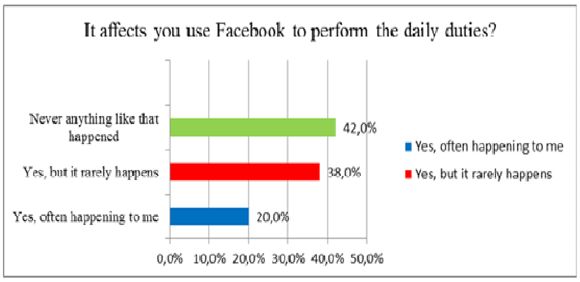

Figure 8. The impact of Facebook on daily responsibilities

Table 2 shows the percentages of the responses to the questions and indicated (shaded and in bold) percentages to think about and open debate. From the attached table shows that students do not use Facebook as it should and that a number of students do not realize Facebook seriously.

TABLE 2. THE PHENOMENA RELATED TO FACEBOOK

QUESTION	% interviewees	
	Yes	No
I accept unknown persons as friends on your Facebook profile?	**22**	78
Arranged to live encounter with a stranger accepted as a friend?	**9**	91
Parents are familiar with what i do on Facebook?	68	**32**
With my parents I arranged / by the rules of using Facebook?	53	**47**
Do your parents have a Facebook profile?	54	**46**
Whether your parents are among friends on Facebook?	49	**51**
Written have some lies about yourself on your profile?	**13**	87
I wrote some lies about another person on the Facebook profile?	**6**	94
I insulted another person on Facebook?	**10**	90
Other people are insulted me on Facebook?	**17**	83

Students sign up lightly, without thinking about setting personal data or content endanger their safety and the safety of their loved ones. Whether they are concerned about security and privacy of their data 55% of students answered that it is not worried, 9% are concerned but do not know how to protect your data, while 36% take care and protect their data (Figure 9).

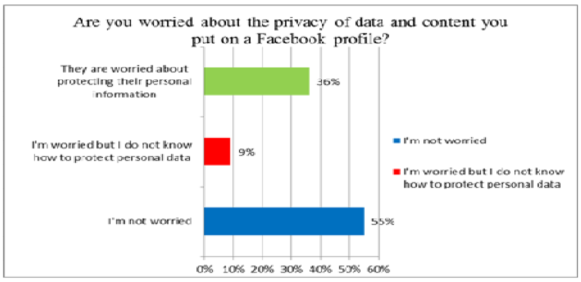

Figure 9. Concerns in using Facebook

If you connect data on the use of the Internet with information on the use of Facebook, we notice that most of the time spent on the Internet students generally spend on Facebook.

IV. Conclusion

Results of the research on the Internet habits of pupils of primary school "Dositej Obradovic"-Smederevo showed that students do not differ from their peers in Serbia, Europe and the world - most of the time spent on Internet use for entertainment activities at social networks. As might be expected the most popular social network is Facebook, which is valid globally for the most popular social network.

It was expected that the students in a more state that Internet use for educational purposes, however, the results showed that only 1/5 of students use the Internet for learning and extending the knowledge of current school subjects. This opens up the teaching staff to schools in this field of preventive and educational works. It is necessary to devise a strategy that would, through various forms of school and other extracurricular activities within the regular education process the students stimulated to time spent on the Internet channel in the direction of better use of the global network. It is also necessary to meet with the parents and with the results of the research, then the potential hazards and threats that accompany the "unsafe" use the Internet and to emphasize the necessity of controlling the time and the content that their children on the Internet following. Although allows quick and easy access to information and provides a number of advantages in the sphere of creating new forms of human interaction, it has its flaws that should not be ignored. If, in this context, to create awareness of children, and joint efforts between schools and parents, it will in future be able to intenet see good and useful ally.

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CHILDREN SECURITY AND SAFETY ON THE INTERNET

ROLE OF PARENTS IN PROTECTING CHILDREN ON THE INTERNET

D. Karuović[*], D. Milanov[*], J. Bushati[**], M. Ćoćkalo-Hronjec[***], N. Novaković[*]
[*]University of Novi Sad, Technical Faculty “Mihajlo Pupin”, Zrenjanin, Republic of Serbia
[**]University of Shkodra “Luigj Gurakuqi“, Faculty of Educational Sciences, Republic of Albania
[***]High school "Laza Kostić", Laze Lazarevića 1, Novi Sad, Republic of Serbia
dijanakaruovic@gmail.com

Abstract - This paper deals with the research of Internet use purposes, frequency of using the Internet, then the question of whether there is supervision by parents when using the Internet and to what extent, with first grade students of economic schools. The frame of these questions tends to reach students' attitudes towards the Internet and its impact on education. The total sample consisted of 177 students, of which 121 girls and 56 boys. The results suggest a significant lack of parental involvement in children's use of the Internet.

I. INTRODUCTION

The most advance "gadgets" and different types of Internet connections have been available to young people in all countries of the world, since the earliest times. Likewise, the use of smart phones and tablet PCs among teenagers has increased drastically in the last two or three years, as well as their connection to the Internet via mobile phones. Today many teenagers use the Internet almost exclusively through their own smartphone.

The Internet is an important source of information and communication, as well as an integral part of the social environment, especially for young people. For proper use of the Internet, young people must be comprehensively informed about all the good and bad sides of it. Also, teachers and parents need to complement existing work with young people through informing them. Besides the role of informing young people, supporting them to find the right information and to make independent decisions, informing youth through parents and teachers in the school fully enables them to maximize the benefits of using the Internet and reduce possible risks.

Surely, the Internet is today one of the most common channel for the exchange of all types of information and communication with each other. The intensive use of the Internet in recent years has introduced completely new qualities into people’s relationships. The Internet has practically and substantially changed the usual way of life for all of us. Certainly, the rise of the Internet enabled for us to overcome technological barriers, so today the Internet is a platform that allows for a relatively inexpensive form of communication among users worldwide, with the availability of information through a few mouse clicks.

However, today perhaps more than ever, questions are being raised not only whether there are negative sides of the Internet as well, but what is the real life if you replace it with so called "Cyber life"? Many theorists, philosophers, sociologists deal with the question of how virtual relationships influence real relationships? Is excessive Internet use leading to social isolation of the individual? These are some of the important questions that need to be seriously addressed.

II. INTERNET ADDICTION AMONG ADOLESCENTS

Time spent on the computer during the day is considered to be the most authoritative indicator of the existence of dependency, so if it includes from 4 to 6 hours of free time, it is considered a symptom. In addition, there are some other criteria that determine the presence of this dependence. Most young people use the internet despite seeing various problems its’ overuse can cause. Internet is used as an escape from the problems and feelings of guilt, depression and helplessness. Especially among young people, the Internet is a kind of stress reducer and escape into parallel and virtual reality.

Some of the psychological signs and symptoms of Internet addiction include: loss of the notion of time spent on the internet, problems related to the completion of tasks at home, work or at school, isolation from family and friends, feelings of guilt or patronizing attitude towards the use of Internet, a sense of euphoria when using the Internet, moodiness, irritability and angry outbursts, feelings of seclusion, depression and resentment, increase tolerance and loss of interest in other activities, lack of concentration and emotional closeness when internet is not available, insincere and frequent lying, irritability when reducing the use of the Internet [6].

III. Importance of Youth Security on the Internet

Based on observations and experiences we all know that teenagers are the leading user population of mobile technologies and also that ways of using these technologies and behavior on the Internet also reflect their future views and opinions. Mobile technologies and social networks are also giving them a kind of freedom and independence, which fits perfectly with the spirit of a young man. This kind of independence may sometimes concern their parents, because it is difficult, or even completely impossible, if they are not accustomed to the Internet and computer technologies, to find out which sites and what content their children are searching on the Internet.

The Internet provides a variety of opportunities for harassment. It is possible to set the rumors, photographs or other personal information on the Internet, and send malicious messages - anonymously, or under someone else's name. SMS messages and mobile phones with camera open up new possibilities for entertainment but also for abuse. School violence is usually limited to the time spent in school, but through the Internet victims are available at any time. There are also a larger number of potential victims online. If a young person spends time for example chatting online, these risks should be discussed at the very beginning. Also, procedures in case of being subjected to harassment should be specified [4].

Why is it important to introduce young people to the problem of harassment on the Internet and electronic violence? It is important for the following reasons: violence on the network often happens when adults are not present, children usually believe that things will get worse if said to parents, anonymity and reduced risk of identification usually encourage people to do something they normally would not have done (for example, to say something that you would not normally say to another person in the face), violence on the network is technically easy to perform. Sending malicious messages or displaying malicious text to large number of users requires only a few mouse clicks.

The main task is to teach our children how to safely use the internet and mobile phone, and how to recognize potential danger and risky behavior. They must be taught to take responsibility for their behavior and the consequences of certain actions that can affect themselves, but also others with whom they are in contact. It is important to respect their independence, interests and activities in accordance with their age, as well as use the messages that are tailored to this age. And finally, what is the most important - communication or conversation. This is especially important because there are many facts that show that children whose parents are paying much attention to talking to children about the dangers on the Internet showed significantly greater awareness of the risks, for example of placing personal information on the Internet, than children whose parents hardly ever talk about this topic.

IV. Role of Parents in Protecting Children on the Internet

There is general advice for all parents, which can be applied not only for using the Internet, but also for all other situations regarding the safety of children. This advice is to be very familiar with what their children are doing, and know roughly their circle of friends. After that, it's good to pay attention to their behavior. If they spend more time outside the home than before, or in their room sitting at a computer, again more attention should be dedicated. Whether it comes to games, the chat, Facebook, it is very important to know what the child is doing. If a child is behaving differently or strangely, parents need to find out why their child behaves differently, and whether there is a risk to his safety. Children and young people's parents should always point out how important it is not to believe everything they are told, and also to always consult with parents before making a decision.

Parents should explain to their children that they should never send their photo to strangers when asked to do it online, not to become familiar with these people before they talk about it with their parents or guardians, and if eventually they are going to meet new people, to tell their parents, as well as to meet always in a public place. Also, when on the internet, and someone sends an indecent proposal or a word, children should stop this type of communication, and tell their parents or guardians about what happened.

It is very important that young people do not misunderstand this kind of parent's behavior to be directed against the fun or use internet in general, but only against the occurrence of possible abuse on the Internet. The Internet is a very good and useful thing that makes life easier and can amuse us. However, at the same time, the Internet is full of various criminals and sick or disturbed people who have dishonorable intentions toward children and youth.

Rules of parental control of children when using the Internet:

- introduce them to electronic media, the possibilities offered and the dangers of the virtual world,
- allow children to eventually teach adults about some uses of electronic media,
- talk with children about the possibilities of using electronic media, dangers and possible consequences,
- arrange the rules of using the internet with your children,
- instruct children on the positive content and features,
- encourage the use of electronic media as a tool for learning and socializing and not just for games,
- spend some time together with children on the Internet,
- introduce Web Sites designed for children and age appropriate,
- monitor the child's activity on the Internet,
- set some limitations for using the Internet,
- place the computer in a visible place (lounge),
- warn children not to give out personal data or photos on the Internet, and not to respond to calls for meeting with strangers,
- if the child wants to meet with someone he met on the Internet, it must be in a public place in the presence of parents,
- the children need to be supported in the reporting of possible electronic violence,
- it should be noted that they are not to blame if they are victims of electronic violence, and that their computer will not be confiscated (this is often the main reason why children do not tell their parents about electronic violence [10].

If the violence happens on the Internet in which the victim is a child or a minor, then you should do the following:

- instruct children not to respond to violent messages,
- do not delete messages as they may serve as evidence,
- try to discover the identity of the perpetrator,
- contact Internet providers,
- contact school,
- if the identity of the perpetrator is known, try to contact his parents,
- contact the police [10].

There are general advices to minors, as recommended by the relevant ministry (Ministry of Internal Affairs of the Republic of Serbia). These are as follows:

- do not send messages, photos or other material that could harm someone, send images only to people who you personally know and who you trust and only after consultation with the parents;
- do not leave personal information to strangers;
- ignore unknown persons wishing to make contact with you and do not meet with these people;
- on home pages of social networks (Facebook, Twitter ...) there are rules for the use of personal data, advices and the age limit for using the network [11].

Proper and timely education and preventive programs can provide children with protection from the dangers of the Internet. Parents and employees of educational institutions – teachers have the key role in this education.

V. Research

A. *The research problem*

The problem of this research is the frequency of use as well as the purpose of using the Internet (e.g., playing games, surfing the Internet, messaging, listening to music, watching movies, writing articles, learning, programming, or any other purpose), and whether there is parental supervision when using the Internet and to what extent.

B. Goal

The goal of the research is set based on the above research problem. The goal was formulated in two ways:

1) Theoretical goal - establish the frequency of Internet use by students and the frequency of experiencing some form of electronic violence, if experienced, with techniques and instruments for pedagogical research.

2) Cognitive objective - to obtain the opinions and attitudes of pupils in relation to the purpose of using the internet and parental control of that usage.

C. Research tasks

According to the research goals, the concrete tasks of the research and their implementation are defined. The tasks of this research are:

1) To investigate the frequency of Internet use by students - participants.

2) To examine the purpose of using the Internet by students - participants.

3) To examine the frequency of any of the electronic forms of violence they were exposed to when using the Internet.

4) Examine the experiences of students on security issues on the Internet, consultation with parents on ways to protect themselves on the Internet and awareness of parental control and any agreed rules for using the Internet.

D. Research hypothesis

Hypotheses for this research are:

- Most first grade students of economics school who use the Internet for entertainment and communication with friends, use the internet daily;
- First grade students of economics school are not being exposed to some form of electronic violence in a significant extent;
- In most cases there is no supervision by parents when using the Internet.

E. Research sample

First grade students of economics school were selected for this research. The research was conducted in the same school during the teaching of Informatics course. Total sample consists of 177 students. The number of boys is 56 or 31.64%, while the number of girls was 121, or 68.36% of the sample.

F. Organization and course of research

The survey was carried out in a way that the students were given anonymous questionnaire of A4 paper format, with five questions, two of which contained questions with the scale of attitudes, from "completely false" to "mostly false," "I'm not sure" to "mostly true "and" completely true ".

VI. Data Processing and Comments

A. Frequency of Internet use

Frequency of Internet use is determined on the basis of two questions in the survey, which are: How often do you use the internet (on your computer, tablet, mobile phone or similar device)? There were offered a total of 6 responses to this question (" I use the Internet daily," "I use the Internet several times a week", "I use the internet once a week ", "I use the Internet once a month", "I use the Internet once in 2-3 months," and "I do not use the internet"). Based on results processing, it be concluded that almost all respondents, in very high percentage (96.43% of boys and 93.38% of girls) use the Internet every day. It can also be concluded that the whole sample of respondents use the internet, because the answer "I do not use the Internet." was not given. It should be noted that there is no significant difference between the intensity of internet use between the two variables (half of respondents).

B. Frequency of experienced electronic violence when using the Internet

The frequency of experienced electronic violence when using the Internet is analyzed based on the obtained data shown on chart 1.

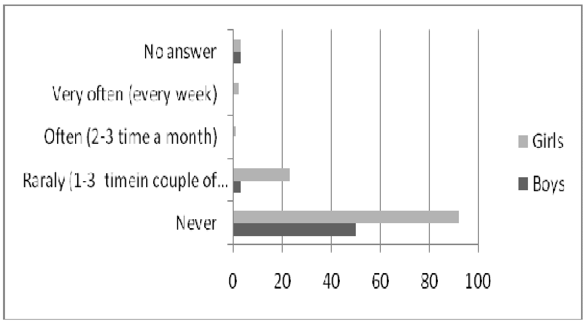

Chart 1. Frequency of experienced electronic violence when using the Internet

C. Parental control of internet use

Processing of research results shows following conclusions:

- for the statement *Parents have warned me of the possible dangers if I meet live with someone I know only via the internet*, percentage of the attitude "completely true" in boys is 10.71, which is different from just 4.96% in girls, and the standard deviation is also significantly higher in boys (1.34 compared to 1.04 in girls), which means that in girls there is less deviation of given attitudes in relation to the arithmetic mean, which is slightly higher in girls;
- for the statement *Parents show interest in what I'm doing while I'm on the computer*, a percentage share of the claim "completely true" is significantly higher in boys than in girls (25% compared to 13.22%) and the standard deviation in both cases are very similar (1.36 and 1.34);
- for the statement *I have agreed rules about using the internet with parents*, percentage share of the attitude "completely true" is significantly higher than in the previous two claims, 53,72% for girls and 44.64% for boys and standard deviations are also very similar (1.35 and 1.34);
- for the statement *I talk to parents about possible dangers of internet*, percentage share of the attitude "completely true" in boys is slightly higher (35.71% compared to 23.97%), the standard deviation is different, so in boys is 1.38 and in girls is 1.55;
- for the statement *I have limited time to spend on the computer and internet*, percentage share of the attitude "completely true" in girls is slightly higher (66.94% compared to 53.57%), standard deviations are largely different, 1.33 in boys and in girls is 0.94, which represents the smallest amount of standard deviations for all attitudes for this statement;
- for the statement *I have to take consequences agreed with parents if I break any of the rules*, percentage share of the attitude "completely true" in girls is slightly higher (62.81% compared to 57.14%) and the standard deviation greatly differs, 1.09 in girls and in boys 1.50, which represents the largest amount of the standard deviation of all attitudes for this statement;
- for the statement *At home computer there are special filters and programs installed to control the content*, percentage share of the attitude "completely true" is significantly higher in girls than in boys (61.16% compared to 42.86%), and standard deviations are high and differ related to respondents' gender (1.50 boys and girls 1.27).

From the above comments it can be concluded:

- from all offered statements, *Parents have warned me of the possible dangers if I meet live with someone I know only via the internet* stands out because it has a significantly larger amount of arithmetic mean in relation to other claims (4.02 for boys and 4.44 in girls), which corresponds to the attitude "mostly true". For all other claims arithmetic mean is moving from the amount of 1.54 to 3.33;
- girls have a higher amount of limited time to spend on the Internet compared to boys;
- it can be said that parents show greater interest for boys while on the Internet, and also boys talk to their parents about possible dangers on the Internet more than girls;
- it can be said that girls have more agreed rules of using the internet, that they have agreed consequences with parents if they violate the rules of using the internet, and at home on the computer have more special filters and programs installed to control the content, compared to boys.

VII. CONCLUSION

From the conducted research it is clearly visible that absolutely all respondents use the Internet and a huge majority (96.43% of boys and 93.38% of girls) uses the Internet every day. So it is almost unimaginable today those first grade students of economics school spend a day without the internet.

Respondents, based on gender, vary when it comes to purpose of using the Internet. It was found that girls, more often than boys, statistically more often use the internet for correspondence with friends and to search for additional literature for school and school assignments. For purposes such as visiting social networking websites and seeking entertainment, boys are statistically leading. As for visiting and reading other people's

blogs, and writing their own blog, girls and boys did not differ significantly, but they also did not showed particular interest for this activity. In addition, it is concluded that the three most common purposes of using the Internet for both genders are identical (correspondence with friends, visiting social networking websites: Facebook, MySpace, etc., and seeking entertaining content).
Described gender differences of purpose of Internet use confirm the typical image that girls compared to boys get more socialized, that their relationships with other people are more important to them, and the same is true in the virtual world. The boys, in line with expectations, research more content on the Internet, are more prone to adventurism and risk behavior. However, it turned out that boys more often than girls spend time on forums and different chat pages, which somewhat mitigates the assumption that boys do not socialize. In this kind of Internet usage, boys are not primarily there to hang out (as it is for girls), but rather to find and exchange information on specific issues of interest.

First grade students of economics school have never been exposed to any form of electronic violence in a large percentage (89.28% of boys, 76.04% of girls and 80.23% in sum). Girls have been more exposed to occasional electronic violence (1-3 times in the last few months).

The results suggest that the parents are not sufficiently involved in children's use of the Internet, and the involvement of parents in this age group should be an important factor in forming their attitudes toward the dangers of electronic media. Only the statement *Parents have warned me of the possible dangers if I meet live with someone I know only via the internet* can be set aside, because it has significantly higher amount of arithmetic mean in relation to other claims, which corresponds to the attitude "mostly true". These results are not to be neglected because the electronic violence is only one aspect of overall bullying of children and it needs to be suppressed with prevention, along with all other types of violence, because the causes of all forms of violence are mostly the same.

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CHILDREN AND CYBERSECURITY

S. Stanković
Redmond, WA, USA
sonjadstankovic@yahoo.com

Abstract – Multimedia devices are accessible to many. They provide affordable way for people to get information, and entertainment. Most of the devices provide internet access, via Wi-Fi or cell phone carriers. The devices have short guides on how to be used, but do not provide guides on how to be safe while using them.

I. INTRODUCTION

As we are becoming an online society, where anyone with a specific data can transfer money, make purchases online, or book a vacation, it is very important to understand potential dangers and how to protect yourself from them.

Internet is a great place where you can find out latest news, chat with your friends, play games, and watch photos of cats. Also it is a tool that people are using to find new ways for criminal acts to take place.

As our children get access to internet, it is crucial to protect them from predators. That can be achieved by raising awareness of dangers, and educating children and parents on how to avoid them.

Common danger encountered by children that is addressed in this paper is when goal is to collect personal information. This is called phishing.

II. PHISHING

Phishing is the attempt to acquire personal information by pretending to be a trustworthy entity [1].

The personal information targeted are usually usernames, passwords, pins, phone numbers, addresses, dates of births, daily schedules, etc. All this can be used to gain access to private information, bank accounts, or any other commodity that attacker can use.

It is usually in a form of an email, instant message, or a pop-up on a page, with a link that will take user to a phisher's page where you need to enter personal information, or it will download a malicious software that can send data from your device to the phisher.

Common schemes are:

- Letter from the bank that you have transaction pending and need to enter data where to send the money
- Confirmation that you won an award and you need to enter data so that they know where to send the award

All these messages appear to be from a legitimate source, and it can be difficult to spot a phishing attempt. Common clues that something is wrong can be spelling errors, or a link that will take you to a different website, and not to the expected one. But you need to be aware of this, and to check it before clicking any links in the message provided.

Phishing has a wide impact, because in many cases it is not device-specific. Anyone who has an email, or IM account can be affected, anyone who goes to any chat room can be a victim.

III. PHISHING AND CHILDREN

Children probably won't have their parents' bank account information, but they can have enough information to be valuable to the phisher, such as address, phone number. They can also provide information such as a daily schedule, commonly visited places, or they can download a malicious software.

Few years ago I was teaching computer science to 7th grade, and during a recess in my computer lab, 13 year old girl was in a chat room (Pricaonica) on http://www.krstarica.com/. I noticed that she was typing her cell phone number in the IM window. I stopped her, asking why she is sharing her number. She said that she is exchanging numbers with a boy she met online; he is from a nearby city, and he is 14 years old. I asked her how confident she is that information is valid. How can she be sure that he is not some 45 year old? I also asked that if she told him that she is 25 year old, how could that be confirmed as a true data? She was surprised by all this, and decided not to give him his number.

That event showed me that kids are not aware of potential dangers on the Internet, but if they are educated, they will be careful and take necessary actions to stay safe.

Here are few more hypothetical scenarios.

Scenario: your 10 year old is playing a game on Facebook, and there is a pop-up: "*You are selected to get for free new IPad! Click to confirm you want your award!*" What will he/she click? Will she close pop-up on a top right "Close" button, or click on an "OK" which is right in the middle of the pop-up? What will clicking on "OK" going to do? Will it take him/her to some website where personal data should be entered, or will it silently install "OpenPortInFirewall.bat" on your device?

Scenario: your 12 year old is in the public chat room, and someone posts: "*Oh, my math teacher is killing me with all the homework. Who feels the same?*" He/She answers "*OMG, I know how you feel*". And then there is an invitation for a private chat from that person, with topic of exchanging experiences with math teachers… and slowly that becomes more personal, asking for name, favorite treat, address, phone number, and an invitation to meet in person. What starts like a friendly online chat between teenagers, can become a way for a phisher to get personal information, and maybe even physical access to the victim.

IV. Protecting and Preventing

To protect yourself and your family from cyber threats, it is very important to be educated of potential dangers of the Internet. It is also important to watch what your child is doing online. Some devices support "child mode" where specific features can be disabled, so your child might watch YouTube videos, but can't open URLs in browser, or download anything over internet.

Common guideline for online safety that every child and parent should know is: treat interaction online same as you would in person; don't talk to strangers, and don't share personal information.

Sounds simple, right? But then you spend hours in the chat room with "Mark" who is the same age as you, and has the same problems as you do… and slowly personal conversation starts that includes information sharing.

There are several campaigns that are dedicated to raising awareness of cyber threats and understanding them. There you can find valuable resources related to online safety.

"Stop.Think.Connect" is a national campaign in US, and stands for:

- "Stop – before you use Internet, take time to understand the risks and spot potential problems
- Think – Take a moment to be certain the path ahead is clear. Consider how your actions online could impact your safety, or your family's.
- Connect – Enjoy the Internet with greater confidence knowing you've taken the right steps to safeguard yourself and your computer." [2]

Another source of information on Cyber security is National Cyber Security Alliance which has a mission to educate and empower digital society to use the Internet safely and securely at home, work, and school. [3]

Many schools are adding to their curriculum content related to online etiquette, and cyber safety. It is a very important topic, as we are enabling our children to use technology available, we need to also teach them to stay safe while doing so.

V. Conclusion

Educators and parents need to talk to children and educate them of potential dangers. Only when we know in what ways cyber criminals can attack us, we can avoid the attacks and protect ourselves. It can be challenging to stay current, but attackers are coming up with new ways to approach victims and get the information they need, and we need to do our best to stay safe.

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THE IMPORTANCE OF KNOWLEDGE OF ENGLISH LANGUAGE FOR SAFE USE OF THE INTERNET IN CHILDHOOD

N. Tešić, D. Maravić, E. Tobolka
Tehnical faculty ”Mihajlo Pupin”, Zrenjanin, Republic of Serbia
ntesic91@hotmail.com, david.serbia@gmail.com, tobolka@eunet.rs

Abstract - The need for English proficiency in the use of the Internet is if not greater, then at least equal to the daily use of the English language in our country. Children, because of their ignorance and lack of knowledge of the English language are visiting various sites and engage in them by age inappropriate situations and conversations. Today's means of communication are available at younger age, which indicates the need for English language learning from youngest days. Their unmonitored use in conjunction with the nature of children characterized by a desire for fun, curiosity and naivety - significantly increases the level of risk of violence in the Internet. Bearing in mind the information about the amount of content on the Internet is in English, the early learning of English is imposed as a priority.

I. INTRODUCTION

Our children are the greatest value of our people. They represent the bright future of our country. Children are also the most vulnerable members of society. National priority of each country must be the protection of children from the fear of crime and how to avoid becoming a victim of the same. A computer with Internet access opens up many possibilities for children, exposing them to different cultures and ways of life. However, in this way they may be exposed to the dangers lurking on the internet. In fact, more than 50% of content on the Internet is in English. Children, because of their ignorance and lack of knowledge of the English language are visiting various sites and engage in them by age inappropriate situations, conversations...

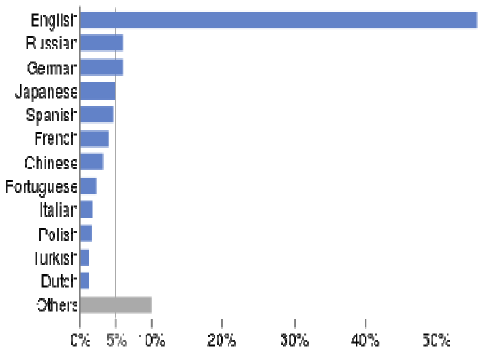

Figure 1. Graphic presentation of linguistic representation on the internet expressed in percentages

II. DIRECTIONS OF PREVENTION

The task of parents is that to instruct their child to what is good and useful for him to deflect him from what is useless and dangerous. The attitude of "better to be in his room, at least I know where he is..." does not provide any protection, if the child is communicating with the bad guy and absorbs their pernicious ideas via the Internet. The passivity of parents plays a key role in the high level of risk that threatens their child. They should be aware of the fact that, when buying your child a computer, they also are learning about a new world that does not need a lot of knowledge, but it takes a lot of precautions, dedication and constant study of the child's interests.

Directions of prevention:

- as better as possible English language skills of children
- the parents must know their child's interests
- introducing the possibility of beneficial uses of computers to the child
- simply imposing directions for its use
- limiting the computer without the child's knowledge by using special software
- review the history of browsing on the Internet and computer programs
- talk about the sites your child is visiting and commenting on their good and bad characteristics

Children must have good knowledge of English to know to properly ask for what they need, what they are interested in so they would not burst into inappropriate situations they can't deal themselves. Parents need to realize the interests of their child, to be able to follow child's work on computer and on Internet. Parents should familiarize the child with all the opportunities that the Internet provides, as well as to explain how these opportunities can be used for their own purposes. Also, parents should be aware of the content and sites that their children are visiting. This can be achieved by using different programs that monitor and restrict access to sites that are not appropriate to their age. Through talking with children they can also learn a lot and thus, with them, comment about why they are visiting certain sites, as well as their good and bad sides. However, the best solution is prevention, parental involvement in children's activities and their tireless referral of children to let them to learn to distinguish between good and bad. There are many ways for the bad guy to approach to children, and the children themselves should, with the help of parents, learn to recognize them already in the initial stage, on a general level, and that by itself vigorously block such contacts.

III. CHALLENGES FOR CHILDREN

Today's means of communication are available and younger age, which indicates the need for English language learning from youngest days. Their unmonitored use in conjunction with the nature of children characterized by a desire for fun, curiosity and naivety - significantly increases the level of risk of violence in the Internet. In the youngest age, the essential characteristics of the child is that they are the most fertile ground for various abuses, while in the older ages strong influences of the environment are present. The influence of the environment is formed usually in the society of network users. They transfer they cyber experience and knowledge to their peers. For children it is quite common to prevail the desire to experience what their generation have experienced before. The challenges for children might be many and the creators of sites will bear that in mind all the times, so they would somehow manage to achieve their goals. Bearing in mind the information that what amount of content on the Internet is in English, the early learning of English is imposed as a priority. On the other hand, parents at all times should keep in mind that their child does not play with the computer than with people who design websites and computer games with a purpose, usually negative for a particular type of user. Even if these influences are seemingly neutral, they are leaving negative consequences, because excessive absorption of meaningless and useless information may constitute a futile lost part of his childhood. Computer should be presented to the child as a useful tool for work, not as a tool for infinite games and entertainment. The second step are mind-blinding games. Rare are, however, useful games and such are often considered boring. 96% of the games on the Internet are in English, and because of them it is essential that children as early as possible start learning English. Computer games are one of the negative forms of entertainment that Internet offers, since hushed have a strong impact on the behavior and personality of a child. The third step is precisely the Internet, with all its good and bad characteristics. Essentially, it is not some kind of evil that arises to contemporary man. Like everything else, the Internet has its good and bad aspects. As in all other areas of life, on the Internet will always be someone who will take advantage of the offered possibility for achieving their bad intentions. What is necessary for the parents to do at the beginning of a child-computer introducing, is that his imagination is directed towards its basic interests. Attitude towards the computer must be channeled to its positive value in use. The biggest part of the problem consists in the perception of the Internet as part of a computer, but also because it is seen more as a game rather than an useful thing. Parents additional false sense of security is provided by the thing that a child who surfs the Internet all the time is at home, in his room. However, pedophiles talk with their children only a few meters away from the living room where they reside. Children are taught earlier by their parents not to come into contact with strangers, but today they just do not realize that the Internet is a way with the highest possibilities for communication. Parents should know that their child is in a high-risk position, because every day he gets in touch with a bunch of unknown and potentially dangerous people.

IV. FORNICATION

One of the most common ways of abuse of juveniles on the Internet is fornication. Surveys conducted in Croatia have confirmed the results of the global statistics on which one in four girls and one in six boy experience some form of sexual abuse. Pre-teen children and teens in the age from 10 to 13 who have not yet been able to define themselves, or to easily distinguish between normal and unusual attitude of other adults towards them, because and which are most susceptible to influence are the most exposed to the negative content on the Internet. Attacks on them are direct and violent, and they usually start by talking in forums or in chat rooms, falsely represented "hunters". After some time socializing and gaining the trust of the victim, "hunter" schedule a personal meeting. The juvenile was convinced that it should be acquainted with a peer, but a surprise that will follow the meeting will end, in most cases with violence. After that, the victim is compelled to silence and repetition of the act by blackmail and fear. The consequences, psychological, and often physical in nature, retains permanent and, as such, fully coincide with the classical abuse or rape.

V. CONCLUSION

The knowledge of English language is crucial for Internet technology. The need for English proficiency in the use of the Internet is if not greater, then at least equal to the daily use of the English language in our country. Children must have good knowledge of English to know to properly ask for what they need, what they are interested in, so they would not burst into inappropriate situations they can't deal themselves. Parents need to realize the interests of their child, to be able to follow his work on computer and Internet use. Parents should familiarize the child with all the opportunities that the Internet provides, as well as to explain how these opportunities can be used for their own purposes.

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CURRICULUM OF CONTEMPORARY TEACHING

THE SELECTION CRITERIA FOR THE CHOICE OF TEXTBOOKS USING MULTI-ATTRIBUTE DECISION MAKING METHODS

D. Stanojević[*], M. Popović[**], M. Kuzmanović[**]
[*]Ministry of Education, Science and Technological Development, Belgrade, Republic of Serbia
[**]University of Belgrade, Faculty of Organizational Sciences, Belgrade, Republic of Serbia
darko.stanojevic@mpn.gov.rs; milena.popovic@fon.bg.ac.rs; kuzmanovic.marija@fon.bg.ac.rs;

Abstract - In the educational system, the question of appropriate textbooks selection is a serious problem. Therefore, a serious approach should be taken, since the consequences of a bad textbook choice can be numerous. A research on textbook selection, divided into two phases, has been conducted in this study. In the first phase, pilot research phase, the criteria which influence textbooks selection have been determined, whereas in the second phase, the importance of these criteria has been determined by multiattribute methods: AHP method and Conjoint analysis. The Law on Textbooks and Other Teaching Materials can be amended by the obtained results in order to establish criteria that influence textbooks selection, which enables authors and publishing houses to improve characteristics determining the set criteria.

I. INTRODUCTION

The advantage on the market can be achieved only by high-quality products or services, as well as by competitive prices. Quality, meaning the extent of a customer`s satisfaction, applies not only to the physical aspect of the product, but also to those factors that affect the emotional and social condition of the individual.

In the educational system, the question of textbooks selection is a serious problem, due to increasing corruption as well as due to a great number of publishers appearing nowadays on the market, offering their textbooks, with no clearly defined selection criteria existing. Apart from a large number of offered textbooks, their price is also of great importance, since it is not always adapted to the current economic situation. Therefore, the question is which criteria influence textbooks selection.

In his study, Olorundare (Olorundare, 1998) singled out four criteria for the selection of textbooks: the adequacy of textbooks in relation to the process, the adequacy of textbooks in relation to content, material presentation and teaching ability of the textbook. A decade later, Ramaligela (Ramaligela, 2010) proposes seven criteria for the selection of textbooks: content, connectedness, language, format, context, activities and teaching strategies. In his study, Crismore (Crismore, 1989) states that teachers tend to see a textbook as an ideal one if it is systematic, informational, readable and in accordance with school objectives.

The aim of this study is to establish the criteria that influence textbooks selection by teachers, as well as to establish the significance of these selection criteria. For this purpose, multi-attribute methods will be used: Analytical Hierarchy Process - AHP method and Conjoint analysis.

The conjoint analysis is experimental approach, used in research. Its goal is to evaluate how customers put the value to the product/service characteristics, i.e. to evaluate what is important to them and to which extent, when they are choosing certain product/service.

This paper is organized as follows: Section 2 describes problem of selecting textbooks. Sections 3 and 4 describe AHP method and Conjoint analysis. Survey was conducted and most important findings are given in Section 5. Section 6 provides the concluding remarks.

II. THE CHOICE OF A TEXTBOOK TO BE USED IN TEACHING

In the educational system of the Republic of Serbia, the process of selecting an appropriate textbook to be used in teaching is not precisely defined. There are educational institutions that solved that problem on their own, but there is no official document which contains any clearly defined method for textbooks selection or any criteria that influence the selection of a particular textbook. Therefore, the motive for conducting this research is the lack of defined criteria which will focus the textbook selection process to choosing the best textbook. Furthermore, another reason for conducting this research is the proposal of the Anti-corruption Agency about the necessity of establishing these criteria and their importance in order to improve the quality of textbooks and teaching.

The textbook itself can be seen through material and immaterial aspect: the material aspect of a textbook is certainly its price, which must be compatible with the current purchasing power on the market. In addition to the price, materials out of which textbooks are produced make a big part of the material quality of textbooks. It should also be taken into account which chemicals are to be used in the production process and how they act when exposed to environmental influences (light, temperature, humidity...). As to the immaterial aspect of textbooks, we definitely think of the content of textbooks and the emotions which the content activates among the users. It can be said that this aspect is more important than the previous one, because if it does not comply with the needs of users, its value will not be at a respectable level.

The users of textbooks are mostly primary and secondary school students, and it is therefore very important that the content is in accordance with the curriculum and syllabus as well as with students` age. It is important that the content used by lower grades students is interactive, so that they can gradually get used to their new responsibilities. Vocabulary has to be adapted to their age, and sentences must be clear and not too long.

Only when we reach the balance between material and immaterial aspects, can we speak of an ideal textbook, which should be preceded by establishing of the balance between the factors influencing these aspects.

III. Analytic Hierarchy Process

Analytic Hierarchy Process - AHP method represents the most popular and lately most used method for decision making, where the selection of one of the available alternatives and their ranking is based on several attributes, which have various importance and are expressed using different scales. AHP method allows the flexibility of the decision making process and helps decision makers to set priorities and make a quality decision, taking into account both qualitative and quantitative aspects of the decision (Saaty, 1991). It can therefore be concluded that the main objective of this method is ranking of several alternatives, as well as the choice of the best one from a set of available ones, in situations where decision-making involves a larger number of decision makers, and where there is a larger number of criteria in different time-periods. The ranking/selection is made in relation to the set target.

A. Methodological bases of AHP method

AHP method was developed by Tomas Saaty in the early '70s of the last century (Saaty, 1977; 1980), as an important tool in the analysis of decision-making, in order to solve complex problems whose elements are: objectives, criteria, sub-criteria and alternatives. AHP considers quantitative and qualitative attributes and combines them through the decomposition of complex problems into a model that has the form of a hierarchy. Each level of the hierarchy consists of elements that are influenced by the level above and which can be mutually compared.Hierarchically structured model of decision-making is generally made up of objectives, criteria and alternatives. The objective is on the top of the hierarchy, the criteria are compared to one another in relation to the set objective, while at the last level, the comparison of alternatives is made in relation to the criteria. AHP keeps all parts of the hierarchy in a relationship, so it is easy to see how a change in one factor affects other factors.

IV. Conjoint Analysis

Conjoint analysis is a multivariate method used to find the preferences of respondents for certain products (Hair, Anderson, Tatham and Black, 1999). Conjoint analysis is consistent with Lancaster’s theory of utility maximization, where consumers demand attributes from a given product (Lancaster, 1971; Lusk and Hudson, 2004). The Conjoint analysis is based on the idea that consumers evaluate the value of a product by combining the different amounts of value provided by each attribute.

The attraction of using conjoint analysis is that it asks the respondents to make choices between products defined by a unique set of product attributes in a way resembling what they normally do - by trading off features, one against the other. When asked which attributes they would like, most customers will choose everything on the wish list. Conjoint analysis can establish the relative values of particular attributes and identifies the trade-offs the customers are likely to make in choosing a product and the price they are willing to pay for it.

A conjoint analysis study includes the following key steps (Kuzmanovic, Vagic and Popovic, 2013):

1. Attribute List Formulation. A business problem is defined and an attribute (features) list as well as their performance levels is developed to study the problem.

2. Data collection. Respondents are asked to express the trade-offs they are willing to make among product features by rating, sorting or choosing among hypothetical product concepts.

3. Utility calculation. A set of preference values (also called part worth utilities) is derived from the interview data; they reflect the trade-offs each respondent made.

4. Market Simulation. The utility values are used to predict how buyers will choose among competing products and how their choices are expected to change as product features and/or price are varied.

V. Empirical Study

A. *Subject and objective of research*

The reason for conducting this research is precisely the lack of defined criteria in the process of selecting textbooks leading to the best textbook. Given that this research can serve as a basis for improving the educational system, the subject of the research is criteria that teachers were guided by in the selection of textbooks for teaching. The goal of the research is to determine what the criteria influence on the selection of textbooks and to examine the importance of them.

The research was conducted in cooperation with the Institute for Textbooks and Teachers' Association of the Republic of Serbia. The research had two phases:

Phase I – Pilot research will reveal which of eighteen given criteria influenced the most on the selection of textbooks,

Phase II – The determination of the significance of criteria, which have emerged as a result of the first phase.

B. *Phase I – Pilot research*

The aim of the first phase of the research is to show the most influential offered criteria and also to show the ones that were not listed, but the respondents found important. The research was conducted via online survey, in November 2013. teachers were evaluating eighteen offered criteria with following: ˝not important˝, ˝important˝ and ˝important˝ or 1, 2 or 3 (Table 1).

The study included 770 respondents, whereas 730/770 were valid and taken into further consideration.

Table 1 contains summary assessments of all 18 criteria and their average score. These data reveal that the most important ones are the suitability of language to the age of students and the encouragement to creative thinking. On the other hand, the least important ones are the unification of all parts of the textbook and the separation of parts of the textbook.

The respondents had the opportunity to add some criteria that were not listed. After having analysed their responses, we have concluded that the criteria Author/Authors' team is also important. Hence, we have included in further analysis.

TABLE I. ASSESSMENT OF IMPORTANCE CRITERIA

Criteria	Not important	Less important	Impotrant	Average score
Conciseness in presentation of content	7	64	659	2.89
Prolixity in presentation of content	66	338	326	2.36
Parts of the textbook set are separated	153	344	233	2.11
Parts of the textbook set are set in a blindfold	228	284	218	1.99
Didactic approach	6	60	664	2.90
Methodical approach	5	26	699	2.95
Occupational character of textbooks	25	112	593	2.78
Language adjustment to the students' age	3	15	712	2.97
Encouraging students to think creatively	3	25	702	2.96
The opportunity for students to work independently	2	58	670	2.92
Encourage students' interest in scientific field	7	141	582	2.79

Criteria	Not important	Less important	Impotrant	Average score
Illustrations quality	16	199	515	2.68
Design quality	23	291	416	2.54
Page overview	4	56	670	2.91
The quality of paper and printing	41	322	367	2.45
Price	44	257	429	2.53
Multimedia of textbook set	17	177	536	2.71
Additional materials for teachers are available	18	123	589	2.78

Finally, the results of the first phase of the research show that the following criteria in selecting textbooks stood out as the most important:

1) ˝Didactic approach˝ is an approach in compliance with the learning process, or teaching and learning, concerning the principles of the successful realisation of the educational process, aimed at teaching and learning.

2) ˝Conciseness in presentation of content˝ implies a degree of clarity of content, style figures that were used and the way in which the textbook was written, as well as the level of understanding of unit. This means that ambiguous sentences which create confusion among students should be avoided.

3) ˝Methodical approach˝ is an approach that involves the implementation of principles, rules and methods for teaching a particular subject or a particular teaching discipline.

4) The criteria ˝the opportunities for students to work independently˝ refers to the amount of tasks that are in the textbook that any student can solve by themselves.

5) ˝Encouraging students to think creatively˝ is a process that forces students to think in a new, special and unusual way, and to solve the given problems in their own original way.

6) ˝Page overview˝ of the page refers to the page content, regardless of whether it comes to basic text, additional text, illustrations, questions or tasks. These elements must be well spatially separated in order to ensure transparency and a clear presentation of the content flow.

7) ˝Language adjustment to the students' age˝ implies that the vocabulary and grammatical structures are adjusted to age and are able to facilitate the understanding of the content.

8) ˝Author/Authors' team˝, refers to the number of autors.

The criteria from number 1 to 7, out of 18, are highlighted as ones with the highest impact, while the eighth criteria was taken into consideration because the teachers emphasized its essential nature.

C. Phase II - the importance of establishing criteria based on AHP method and Conjoint analysis

The objective of the second phase of the research is to determine the importance of criteria that will influence on the selection of textbooks that will be used in teaching. For this purpose were used multiatributive methods: AHP method and conjoint analysis.

Determining importance criteria by AHP method

The AHP study included 275 teachers, the research was conducted via online survey in the beginning of 2014 (http://www.istrazivanjazavodzaudzbenike.rs/). Teachers from the Republic of Serbia were able to assess the significance of the criteria. There were two given criteria and the teachers were supposed to compare them-one should be more important or equally important according to their opinion/subjective perception, all based on the rating scale Saati. Collected data were analyzed by using the software program Expert Choice 11. A significance of all eight criteria are given in the Chart 1.

As it can be seen from the graphs, after using AHP method, it was found out that the most important criterion was"Encouraging students to 'creative thinking', while the criterion," Autor / Author had the slightest influence on the selection of textbooks although it was suggested by teachers.

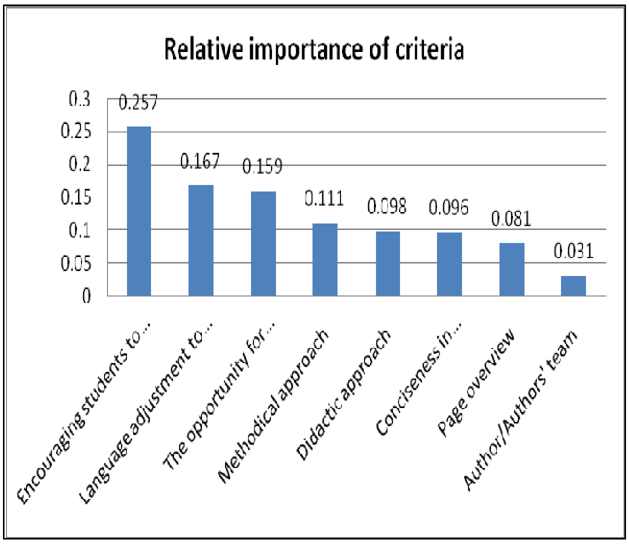

Chart 1. *Relative importance of criteria using AHP method*

Determining the attribute importance using Conjoint analysis

The conjoint survey was fielded in Belgrade, Serbia, in Jun 2014. In total, 82 teachers completed the questionnaire. Teachers were offered examples of textbooks via survey, which they evaluated according to their own perceptions ranging from 1 to 5. The survey was composed of 14 cases of textbooks (profile), and software package SPSS 16.0 was used.

The eight criteria that were abstract in the Pilot research at this stage, represented the attributes of textbooks, and each of them are assigned levels.The attributes and levels assigned to them for the purpose of this study are shown in Table 2.

TABLE 1. AVERAGED PART-WORTH UTILITIES

ID	Criteria / Attribute	Attributes' levels	Part-worths
1.	Author/Authors' team	One Author	0.037
		More Authors	-0.037
2.	Didactic approach	Yes	0.140
		No	-0.140
3.	Conciseness in presentation of contetn	Clearly	0.319
		Confused	-0.319
4.	Methodical approach	Yes	0.140
		No	-0.140
5.	The opportunity for students to work independently	High	0.183
		Low	-0.183
6.	Encouraging students to think creatively	Insufficient	0.049
		Full	-0.049
7.	Page overview	Good	0.222
		Fair	-0.222
8.	Language adjustment to the students' age	Yes	0.250
		No	-0.250
Constant = 2.449			
Pearson's R = 0.965 Kendall's tau = 0.909 Kendall's tau = 1.000 for 2 Holdouts			

In order to elicit the preferences for the various profiles, in this study a rating approach was utilized. The respondents expressed their preferences for a particular candidate on a scale of 1 to 5, where 1 stands for absolutely undesirable, and 5 stands for absolutely desirable. The survey was conducted using the traditional "paper and pencil" method.

Results from the analysis are shown in Table 2 and Chart 2. Table 2 presents the (averaged) part-worth of each level of the attributes, while Chart 2 is the graph description of the attributes importance.

A high value of the Pearson coefficient, 0.965, confirms the high level of significance of the obtained results (Table 2). Similarly, a high value of the Kendall correlation coefficient, 0.909, indicates a high level of correlation between the observed and estimated preferences. The Kendall coefficient for two holdout profiles has a value of 1.000, which is an additional indicator of the high quality of the obtained data. The constant whose value is 2.449 (Table 2) represents a stochastic error obtained through regression analysis, and it is used to calculate the total utility of each profile.

As Table 2 shows, the most important attribute at the sample level is ˝Conciseness in presentation of content˝, which average importance at the aggregate level is 16.72%. Somewhat lower importance at the aggregate level is attributed to ˝Language adjustment to the students' age˝ (15.15%). Attributes with a relatively greater importance are also ˝Page overview˝ (13.58%) and ˝The opportunity for students to work independently˝ (13.51%). The least important attributes at the aggregate level are ˝Methodical approach˝ and ˝Author/Authors' team˝, whose importances have values of 9.87% and 9.33%, respectively. The ratio of these values is shown in Chart 2.

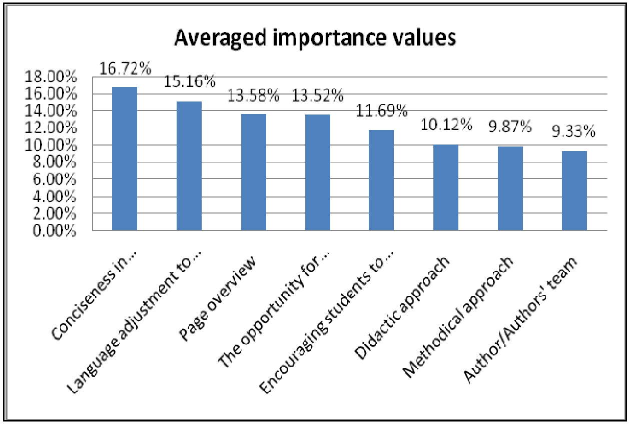

Chart 2. *Averaged importance values using Conjoint analysis*

VI. CONCLUSION

Selection of appropriate textbooks today is a major problem for educators and parents too. On the one hand it is necessary to select one textbook from the crowd of textbooks that fully corresponds to the curriculum, and on the other hand it should be facing the child who will learn from it. Another problem is that the ˝Law of textbooks and other teaching resources˝ doesn't define criteria for the selection of textbooks, so teachers can choose any of textbooks that are offered in the market. Given the fact that on the market are more than 70 textbook publishers, we can say that the selection of appropriate textbook is one of the most difficult tasks that the education system is facing with.

In the research conducted in this study were involved more than a thousand teachers from all areas of the Republic of Serbia, in order to determine the criteria for the selection of appropriate textbooks. Considering that the survey was conducted in two phases, each phase gave the results that contributed in achieving the aim.

In the first phase of a total of 18 criteria, the eight criteria were used in further research, it was established which criterion is the most important when teachers choose textbooks. Based on the results of AHP method, it turned out that the most important criterion is ˝Encouraging students to think creatively˝, meanwhile the least important criteria is ˝Author / Author' team˝. While based on Conjoint analysis, it was showed that the most important criteria is ˝Concision in the presentation of the content˝ and the least important criteria ˝Author / Author' team˝. Interestingly enough, the teachers emphasized criteria ˝ Author/Authors' team˝ in the Pilot research and it turned out to be the least important criteria.

Nowadays, people are most likely to avoid situations in which they have to make key decisions because they do not want to be responsible if some irregularity comes up. Therefore, the idea of this work was to limit the liability of those who choose textbooks by introducing certain criteria that textbooks have to fulfill. On the other hand, publishers will be indicated on which characteristics of textbooks they should pay attention in order of better quality, which will also lead to reduced corruption.

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ON THE USE OF MATHEMATICA IN ENGINEERING EDUCATION

B. Zlatanovska, L. Lazarova, A. Stojanova
Goce Delcev University/Faculty of computer science, Stip, Republic of Macedonia
biljana.zlatanovska@ugd.edu.mk, limonka.lazarova@ugd.edu.mk, aleksandra.stojanova@ugd.edu.mk

Abstract - So far, Mathematica has been used mainly either in teaching as a support for classical courses, or in research as a computing environment. However, it could be assigned a wider and more profound role in mathematics and mathematical education. Many problems that include functions of two variables are too difficult for the students because they cannot visualize these surfaces or give them geometric interpretation. The aim of this paper is to demonstrate how students and educators to visualize the functions of two variables and to help to the students in solving some problems with these functions can use Mathematica.

I. INTRODUCTION

It is not possible to achieve the objectives and skills of a modern mathematics course at the secondary or university level without resorting to graphic concepts. These concepts can be more easily apprehended when the students work with a large number and variety of graphics, in an interactive way, with the support of the appropriate technology. Obviously, calculations with the support of technology are not a replacement for paper and pencil calculations, and they should be properly combined with other methods of calculation, including mental calculation. Students should be prepared for an intelligent dialogue with the tools they have available. There are a great variety of tools and teaching methods available to lecturers who are providing instruction to engineering students in today's colleges and universities. The choices made among these many options are often due to the particular backgrounds and interests of an instructor. The students in the classroom also bring a diversity of experiences and learning styles to the student-teacher relationship. Keeping in mind the responsibility of both instructors and students to communicate effectively with one another as well as to prepare adequately for learning outside of the classroom, engineering instructors should be interested in considering different ways of presenting course material. [8]

So far, Mathematica has been used mainly either in teaching as a support for classical courses, or in research as a computing environment. However, it could be assigned a wider and more profound role in mathematics and mathematical education, [4]. The aim of this paper is to demonstrate how students and educators to visualize the functions of two variables and to help to the students in solving some problems with these functions can use Mathematica. This will improve the teaching-and-learning process precisely by providing teachers and students alike with new ways to explore some of the main mathematical subjects, at the secondary and university levels, specifically in the areas of precalculus and differential calculus.

Wolfram's Mathematica is a powerful (Computer Algebra Systems) CAS used in scientific, engineering, and mathematical fields and in other areas of technical computing. In what concerns the work presented in this paper, Mathematica graphics are completely integrated into its dynamic interactive language. Any visualization can immediately be animated or made interactive using a single command and developed into sophisticated, dynamic visual applications. Creating interactive visual models with Mathematica allows students to explore hard to-understand concepts, test theories, and quickly gain a deeper understanding of the materials being taught firsthand. The students can explore changes to text, functions, formulas, matrices, graphics, tables, or even data, [3].

Mathematica can deliver integrated and affordable high-end dynamic visualization and simulation capabilities. With nVizx™ [5], it enables users to take large volumes of natural and synthetic data, add complex calculations and generate high-resolution, dynamic images for analysis and presentation. Its capabilities in visualization are [6]: transparency, texturing, interactive 3D models, data driven real-time 3D animations, true parametric curves and surfaces plots, fast visualization of large files and etc. Very similar to Mathematica is the Programming packet

Matlab that has the same capabilities in visualization [7].

II. Visualization of the Two Variable Function

Students do not have difficulties for solving problems, which include function with one variable, because this function is easier for graphic illustration. They can do this with pencil on paper. However, when the number of independent variables is larger, then they cannot give geometric interpretation. Because of that, they have problems in some mathematical calculations. They cannot visualize and imagine these surfaces, and because of that, they cannot solve problems with these functions. In mathematics, difficulties often appear because of the lack of geometric visualization.

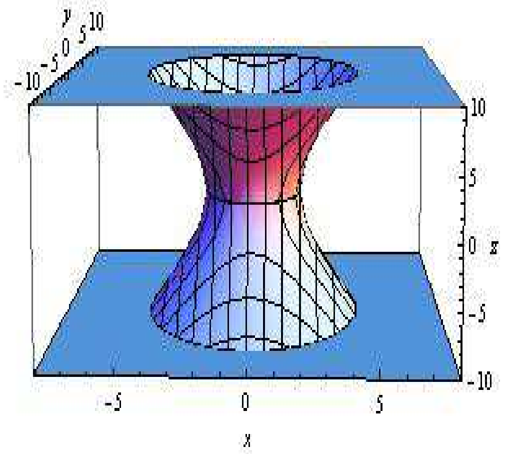
In Multivariable Calculus in engineering studies, students should learn and understand basic mathematical concepts, which have been already studied in one variable Calculus. The Multivariable Calculus is so important for engineering students because they applied these concepts in other engineering areas.

Students can draw the function with one variable with pencil and understand all the important facts about these real functions because their graphics are lines or curves, which are subset to the real plane.

They can distinguish the equation for circular or ellipse, but they cannot distinguish 3D figures because they cannot imagine these surfaces. Because of that, the use of some computational programs for visualization is necessary in the classroom. Mathematica Wolfram is very adequate programming package for using in the classrooms. It is easy for using, because it has simple commands for solving and plotting.

For visualization of function with two variables in Mathematica, the user should use the command Plot3D and to accent the PlotRange for three axes x, y and z.

On the figure 1 is represented a single hyperboloid $\frac{x^2}{4}+\frac{y^2}{9}-\frac{z^2}{25}=1$.



Mathematica has possibility for rotating of the graphics, so this single hyperboloid can be represented from different point of view:

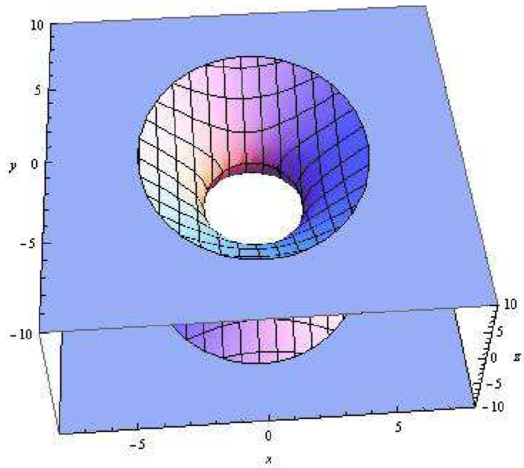


Figure 1. The single hyperboloid $\frac{x^2}{4}+\frac{y^2}{9}-\frac{z^2}{25}=1$.

We should notice that for plotting of two variables function in Mathematica, the functions should be t given in explicit form.

On the figure 2 is given double hyperboloid $\frac{x^2}{4}+\frac{y^2}{9}-\frac{z^2}{25}=-1$, from different point of view.

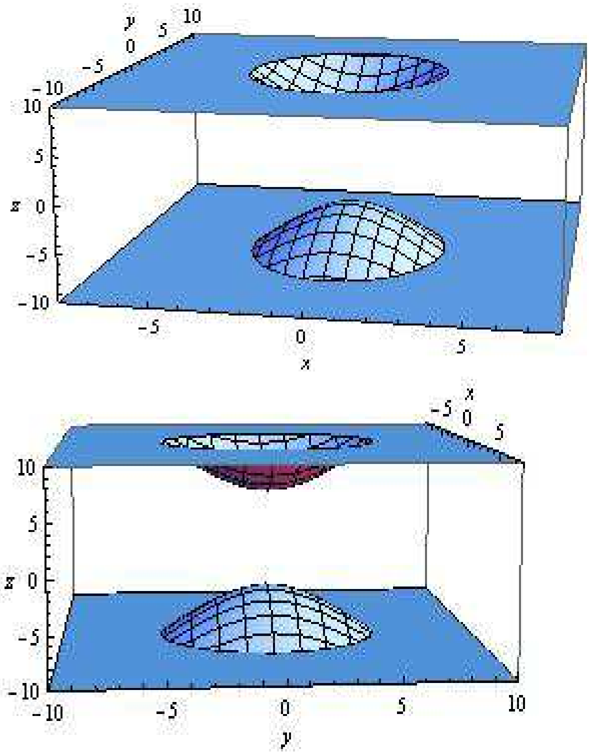


Figure 2. Double hyperboloid $\frac{x^2}{4}+\frac{y^2}{9}-\frac{z^2}{25}=-1$.

On the figure 3 is given hyperbolic paraboloid $z=\frac{x^2}{12}-\frac{y^2}{16}$.

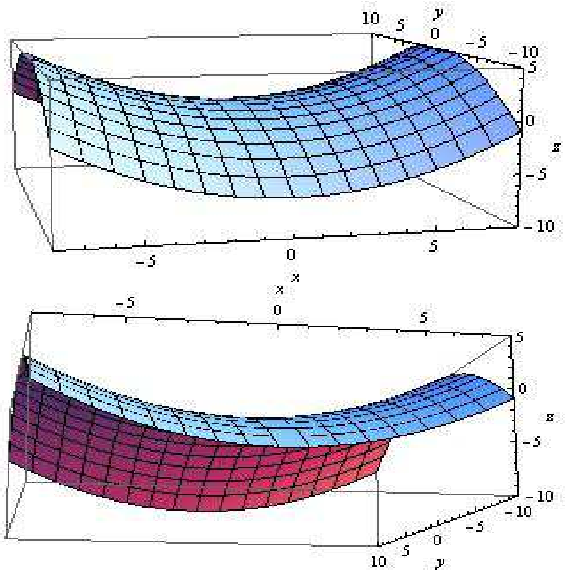


Figure 3. Hyperbolic paraboloid $z=\frac{x^2}{12}-\frac{y^2}{16}$.

These graphical representations could be very helpful for the students when they must calculate the volume of the surfaces area and 3D shapes. From the graphical illustration, they can determine the limits of the surfaces and then can make the necessary calculations in the double integrals. When the surfaces are shown graphically the students can calculate easily some line and surface integrals. That is not as much as easy when they should solve some problems, which are given analytically.

The plane tangent to a surface at a point and the normal line to a surface at a point are difficult to understand without a graphical visualization. Mathematical formulas for the plane tangent to a surface at a point $M_0(x_0, y_0, z_0)$ and for the normal line to a surface at a point $M_0(x_0, y_0, z_0)$ are

$$\left(\frac{\partial z}{\partial x}\right)_{M_0}(x-x_0)+\left(\frac{\partial z}{\partial y}\right)_{M_0}(y-y_0)=z-z_0 \qquad (1)$$

and

$$\frac{x-x_0}{\left(\frac{\partial z}{\partial x}\right)_{M_0}}=\frac{y-y_0}{\left(\frac{\partial z}{\partial y}\right)_{M_0}}=\frac{z-z_0}{-1} \text{ respectively.}$$

In these formulas for tangent plane and normal line of some surface the first partial derivatives appear.

On the figure 4 by a code

```
f1 = Plot3D[{x^2/2 - y^2, 2*x + 2*y - 1}, {x, -8, 8}, {y, -10, 10}, PlotRange
    → {{-8, 8}, {-10, 10}, {-50, 50}}, AxesLabel → {x, y, z}]; f2
    = ParametricPlot3D[{2t + 2, 2t - 1, -t + 1}, {t, -50, 50}]; Show[{f1, f2}]
```

is represented a hyperbolic paraboloid $S: z=\frac{x^2}{2}-y^2$. The tangent plane of the surface is given with the equation $\Sigma: z = 2x + 2y - 1$ and the normal line of the surface is the line $n: \frac{x-2}{2}=\frac{y+1}{2}=\frac{z-1}{-1}$ at a point $M_0(2,-1,1)$.

The code for the first partial derivatives $z'_x=\frac{\partial z}{\partial x}, z'_y=\frac{\partial z}{\partial y}$ of the function $z=f(x,y)$ in terms of the variables x and y is $\partial_x(\frac{x^2}{2}-y^2)$ and $\partial_y(\frac{x^2}{2}-y^2)$, respectively. The code for calculation of the value of the first partial derivatives $z'_x=\frac{\partial z}{\partial x}, z'_y=\frac{\partial z}{\partial y}$ at the point M(2,-1,1) is $\partial_x(\frac{x^2}{2}-y^2)/.x \to 2$ $\partial_y(\frac{x^2}{2}-y^2)/.y \to -1$.

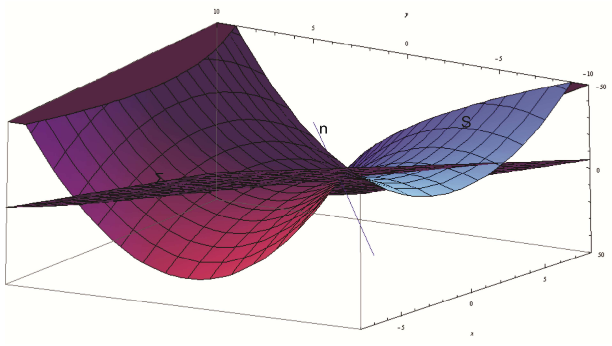


Figure 4. The hyperbolic paraboloid

$S: z = \dfrac{x^2}{2} - y^2$, the plane tangent to the surface $\Sigma: z = 2x + 2y - 1$, the normal line to the surface $n: \dfrac{x-2}{2} = \dfrac{y+1}{2} = \dfrac{z-1}{-1}$ at a point $M_0(2,-1,1)$.

The intersection of two surfaces or a surface with a plane is very complex for explanation by the teacher as well as for a perception by the students. The graphical visualization with Mathematica gives a simpler and a great way for an explanation by the teachers an as well as easier understanding by the students. Therefore, on the figure 5 is represented an intersection of a sphere $(x-5)^2 + (y+3)^2 + z^2 = 25$ with the plane $z = x - 2y - 5$ by the code

```
Plot3D[{√(25 − (x − 5)² − (y + 3)²), −√(25 − (x − 5)² − (y + 3)²), x − 2y
    − 5}, {x, −10,10}, {y, −10,10}, AxesLabel → {x, y, z}, PlotRange
    → {{−10,10}, {−10,10}, {−10,20}}]
```

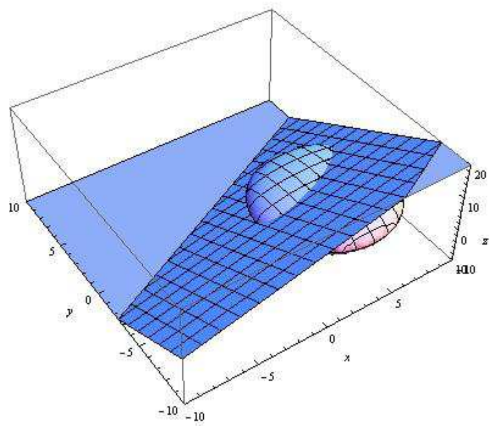


Figure 5. The intersection of a sphere $(x-5)^2 + (y+3)^2 + z^2 = 25$ with the plane $z = x - 2y - 5$.

On the figure 6 is represented an intersection of a sphere $(x-5)^2 + (y+3)^2 + z^2 = 25$ the hyperbolic paraboloid $z = x^2 - y^2$ by the code

```
Plot3D[{√(25  (x  5)²  (y + 3)²),  √(25  (x  5)²  (y + 3)²), x²
y²}, {x, −10,10}, {y, −10,10}, AxesLabel → {x, y, z}, PlotRange →
{{ 10,10}, { 10,10}, { 10,10}}]
```

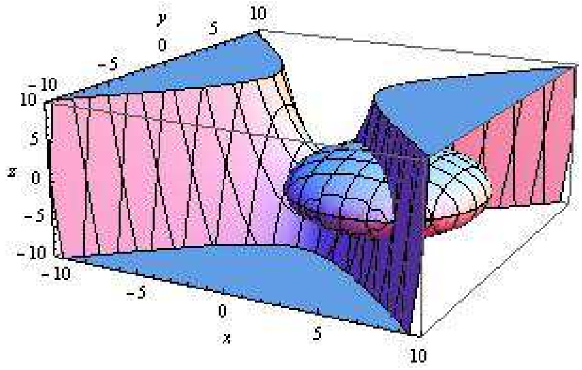


Figure 6. The intersection of a sphere $(x-5)^2 + (y+3)^2 + z^2 = 25$ with the hyperbolic paraboloid $z = x^2 - y^2$.

The intersection of two surfaces or of a surface with a plane is connected with the conditional extremes of the function with two variables. Because, the conditional extreme – maximum or minimum is smallest or biggest point respectively of the surface $z = f(x,y)$ with the plane or the surface $\varphi(x,y) = 0$, which is condition [10].

The point M(1,1,2) is an intersection of the eliptic paraboloid $z = x^2 + y^2$ with the plane $x + y - 2 = 0$. This point is a conditional extreme – minimum for the elliptic paraboloid $z = x^2 + y^2$ with condition $x + y - 2 = 0$, although the point M(1,1,2) is not an extreme for the elliptic paraboloid $z = x^2 + y^2$.

The code for this case is

```
b2 = Plot3D[{√(z − x²), −√(z − x²), −x − 2}, {x, −10,10}, {z, −20,30}, PlotRange
    → {{−10,10}, {−30,30}, {−10,10}}, AxesLabel → {x, z, y}, ViewPoint → {0,2,5}]
```

and the representation is given on the figure 7.

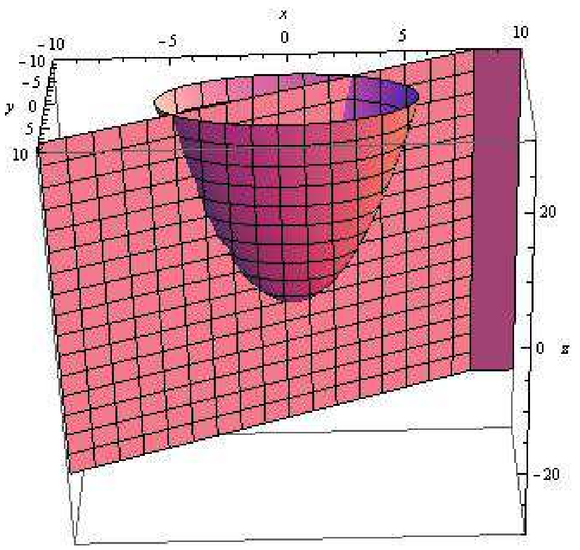


Figure 7. The conditional extreme – minimum M(1,1,2) for the elliptic paraboloid $z = x^2 + y^2$ on condition $x + y - 2 = 0$.

Determining of the first partial derivatives $z'_x = \frac{\partial z}{\partial x}, z'_y = \frac{\partial z}{\partial y}$ for the function $z = f(x, y)$ in terms of the variables x and y at a point is simple. However, a geometric representation is difficult for understanding.

By [9], [10], the geometric representation for a partial derivatives z'_x at the point (x_0, y_0): The surface which geometrically represent the function with two variables $z = f(x, y)$ cut with the plane $y = y_0$ (because when we determine the first partial derivative of the function with two variables in terms of the variable x, the variable y we treat as a constant). If in the plane $y = y_0$, we choose coordinate axes parallel to Ox and Oz axis then we obtain planar curve $z = f(x, y_0) = \varphi(x), y = y_0$. The first derivative $\varphi'(x_0)$ is equal on tangent of an angle between the tangent line $z - z_0 = z'_x(x_0, y_0)(x - x_0), y = y_0$ on the curve at the point $(x_0, \varphi(x_0))$ and positive part of an abscissa axis Ox. Because, the first partial derivative z'_x at the point (x_0, y_0) to the function with two variables $z = f(x, y)$ is equal on a tangent of an angle between positive part of an abscissa axis Ox and the tangent of the curve, which is an intersection on a surface $z = f(x, y)$ and the plane $y = y_0$.

For example, the geometric representation for a partial derivatives z'_x at the point (x_0, y_0) of the single hyperboloid $S: \frac{x^2}{4} + \frac{y^2}{9} - \frac{z^2}{25} = 1$ at the point (2,3):

The single hyperboloid $S: \frac{x^2}{4} + \frac{y^2}{9} - \frac{z^2}{25} = 1$ has the first partial derivative $z'_x = \frac{5x}{4\sqrt{\frac{x^2}{4} + \frac{y^2}{9} - 1}}, z'_x(2,3) = \frac{5}{2}$ with a code

$$\partial_x\left(\pm 5 * \sqrt{\frac{x^2}{4} + \frac{y^2}{9} - 1}\right)$$

The intersection of the surface $S: \frac{x^2}{4} + \frac{y^2}{9} - \frac{z^2}{25} = 1$ with the plane y=3 is given with the curve $\Gamma: \frac{x^2}{4} - \frac{z^2}{25} = 0, y = 3$ in the plane y=3 for the surface S. The point M(2,3,5) is a point of the surface S and of the curve Γ. The tangent line t in real space Oxyz at the point M has the equation $t: z - 5 = \frac{5}{2}(x - 2), y = 3$,where $z'_x(2,3) = \frac{5}{2}$. The tangent of an angle between the tangent t on the curve Γ and the positive part of axis Ox is equal to the first partial derivative $z'_x(2,3) = \frac{5}{2}$ of the S at the point M. In the figure 8 with a code

$$\text{a1} = \text{Plot3D}\left[\left\{3 * \sqrt{-\frac{x^2}{4} + \frac{z^2}{25} + 1}, -3 * \sqrt{-\frac{x^2}{4} + \frac{z^2}{25} + 1}, 3\right\}, \{x, -8, 8\}, \{z, -20, 20\}, \text{AxesLabel} \to \{x, z, y\}, \text{PlotRange} \to \{\{-8, 8\}, \{-20, 20\}, \{-10, 10\}\}\right]; \text{a2} = \text{ParametricPlot3D}\left[\left\{\frac{2}{5} * t + 2, 3, 5 + t\right\}, \{t, -100, 100\}\right]; \text{Show}[\{\text{a1}, \text{a2}\}]$$

is represented the single hyperboloid $S: \frac{x^2}{4} + \frac{y^2}{9} - \frac{z^2}{25} = 1$, the plane y=3, the intersection $\Gamma: \frac{x^2}{4} - \frac{z^2}{25} = 0, y = 3$ and the tangent line $t: z - 5 = \frac{5}{2}(x - 2), y = 3$ at the point M(2,3,5).

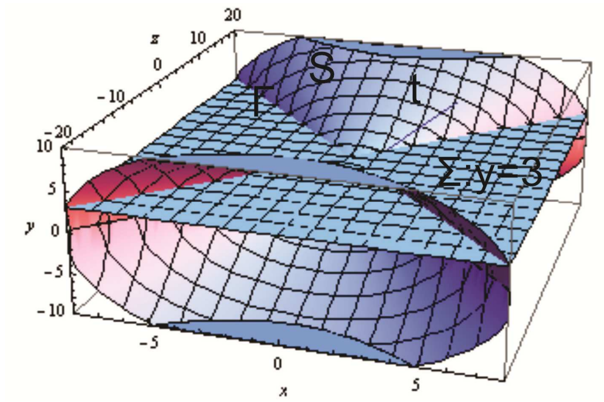


Figure 8. The single hyperboloid

$S:\frac{x^2}{4}+\frac{y^2}{9}-\frac{z^2}{25}=1$, the plane y=3, the intersection $\Gamma:\frac{x^2}{4}-\frac{z^2}{25}=0, y=3$ and the tangent $t:z-5=\frac{5}{2}(x-2), y=3$ at the point M(2,3,5).

In the figure 9 with a code

$$\mathrm{a1}=\mathrm{Plot3D}[\{3*\sqrt{-\frac{x^2}{4}+\frac{z^2}{25}+1},-3*\sqrt{-\frac{x^2}{4}+\frac{z^2}{25}+1},3\},\{x,-8,8\},\{z,-20,20\},\mathrm{AxesLabel}\to\{x,z,y\},\mathrm{PlotRange}\to\{\{-8,8\},\{-20,20\},\{-10,10\}\}];\mathrm{a2}=\mathrm{ParametricPlot3D}[\{\frac{2}{5}*t+2,3,5+t\},\{t,-100,100\}];\mathrm{a3}=\mathrm{Plot3D}[0,\{x,-8,8\},\{y,-10,10\},\mathrm{AxesLabel}\to\{x,y,z\}];\mathrm{Show}[\{\mathrm{a1},\mathrm{a2},\mathrm{a3}\}]$$

is represented the angle α between the tangent t on the curve $\Gamma:\frac{x^2}{4}-\frac{z^2}{25}=0, y=3$ in the plane y=3 with the positive part of Ox axis, which is the first partial derivative $z'_x(2,3)=\frac{5}{2}$ of S at the point M(2,3,5).

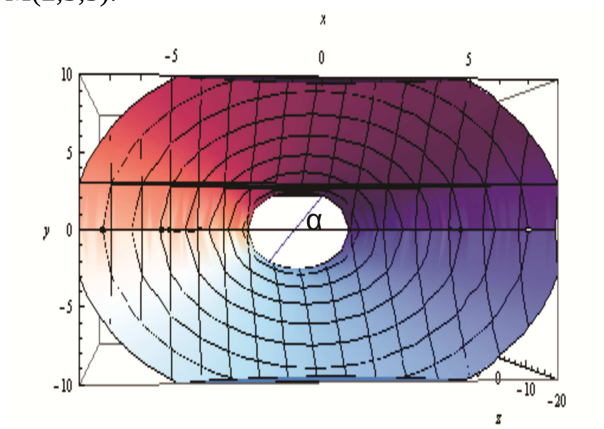


Figure 9. The single hyperboloid

$S:\frac{x^2}{4}+\frac{y^2}{9}-\frac{z^2}{25}=1$, the angle α and the tangent

$t:z-5=\frac{5}{2}(x-2), y=3$ at the point M(2,3,5)

III. CONCLUSION

The use of mathematical computer packages, like Mathematica, provides a great opportunity for instructors to develop their own course materials to supplement their traditional teaching methods and tools and, hopefully, to better reach more students. In this paper, it is shown that Mathematica could be used as an additional tool in solving problems in multi variable calculus.

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ATTITUDE OF SECONDARY STUDENTS TOWARDS MATHEMATICS AND ITS RELATIONSHIP TO ACHIEVEMENT IN MATHEMATICS

T. Atanasova-Pachemska*, L. Lazarova*, J. Arsov*, S. Pacemska**, Z. Trifunov*, T. Kovacheva***
*University "Goce Delcev", Stip, Republic of Macedonia
**Bureau of educational development of the Republic of Macedonia
***Technical University – Varna, Republic of Bulgaria
tatjana.pacemska@ugd.edu.mk, limonka.lazarova@ugd.edu.mk (corresponding author), arsovjoce@gmail.com, zoran.trifunov@ugd.edu.mk, sanja.pacemska@gmail.com, tsetska.kovacheva@tuvarna.acad.bg.

Abstract - Human beings are not only cognitive individuals, but also social persons with beliefs, emotions and views that influence their development as learners. Attitude towards mathematics plays a crucial role in the teaching and learning processes of mathematics. Study of Mathematics at secondary level is the foundation stage of Higher Education. The number of appointed students who take mathematics as a subject of the state graduation is so small. From the other side, mathematics is required for continuing education in technical and natural sciences and mathematics. The subject of this paper is determination the students' attitude towards mathematics in the higher classes in the secondary schools, in Stip, Republic of Macedonia. The results of the survey are processed with statistical software SPSS 21. The ANOVA is applied in order to determine whether there is a significant difference between students' attitudes towards mathematics and the factors, which are the goals of the research. Conclusions and recommendations for improvement are given.

I. INTRODUCTION

Mathematics is a very worthwhile and necessary subject at all levels at primary, secondary and university education. Several studies and researches have been done in many countries to find the factors that influence the students' performance in mathematics. Among these factors, students' attitude towards mathematics is one important factor that has been consistently studied. Students' attitudes toward mathematics have been known to influence students' participation, engagement, and achievement in mathematics. Attitudes are not innate but result from experiences and they can be changed. Attitudes are more stable than emotions and feelings, but at the same time, they are malleable influences on participation, because attitudes are formed in response to curriculum, teaching practices, and organizational arrangements, [2]. An early 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 an important role in causing students to learn mathematics" [10]. Neale in [10] 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" (p. 632). The teaching method, the support of the structure of the school, the family and students' attitude towards school affect the attitudes towards mathematics. Usually, the way that mathematics is represented in the classroom and perceived by students, even when teachers believe they are presenting it in authentic and context dependent way stands to alienate many students from mathematics [9]. Researchers concluded that positive attitude towards mathematics leads students towards success in mathematics [8], [5]. In [11] 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, [7]. Recently, many connected concepts have been studied, such as conceptions and beliefs of Mathematics and its learning, motivation and self-regulation, self-concept, self-esteem and self-efficacy. The general tenet is that human beings are not only cognitive individuals, but also social persons with beliefs, emotions and views that influence their development as learners [6]. Actually, a person's behavior and choices, when confronted with a task, are determined more by her/his beliefs and personal theories, rather than by her/his knowledge of the specifics of the task [3]. The complexity of factors that can influence mathematics performance is demonstrated by Singh, Granville, and Dika [3] where they show that high achievement in mathematics is a function of many interrelated variables related to students, families, and schools. It can be said that students' attitude towards mathematics are very subjective and varies among the students. Many studies claim that there is no significant difference between attitude towards mathematics among male and female students, [8], and [4]. Several studies had been conducted to find out the relationship between attitude towards mathematics and academic achievement of the students. Most of these studies showed that there is a positive correlation between students' attitude towards mathematics and academic achievement of students, [8]. The studies has also shown that students attitude towards problem solving in terms of patience, confidence and willingness has a positive relation with students' mathematics achievement, [8]. The emotional dispositions have an impact on an individual's behavior, as one is likely to achieve better in a subject that one enjoys, has confidence in or finds useful [1]. For this reason, positive attitudes towards mathematics are desirable since they may influence one's willingness to learn and the benefits one can derive from mathematics instruction [1].

II. METHODOLOGY

The mathematical education is in the main focus of attention in the last few decades. On one hand, scholars, designers, and practitioners have produced exciting new developments in research, curriculum, and assessment. New standards for instruction and curriculum have been developed and an international discourse community on mathematics education has grown. On the other hand, mathematics education has been the target of intense criticism and debate among different stakeholders and communities. All these measures which have been taken in many countries, in order to emphasize the importance of mathematics, and to improve the quality of teaching mathematics do not give the expected results with the students, [12]. In the last few years in the Republic of Macedonia, in primary and secondary schools, the Ministry of Education implements more reforms, so that students can gain better knowledge. The problem of improving the capacity of staff in educational institutions has been popularized in order to improve the process of teaching mathematics. Reforms are implemented several years in order to achieve long-term results. Taking into account the current needs of the economy and industry, Ministry of Education of the Republic of Macedonia has developed a campaign to increase the number of students enrolled in a vocational school and the number of graduates who will enhance their education at technical faculties.

The international tests that were made about comparing the achievement of students in the mathematics showed that the level of achievement of the students in Macedonia is under the European countries student's achievements. Because of that, several projects are implemented in the field of mathematical education. However, it seems that the intention of the government institutions does not give the satisfactory results. The number of appointed students who take mathematics as a subject of the state graduation is so small. From the other side, mathematics is required for continuing education in technical and natural sciences and mathematics, so the number of the students in this faculties and schools is also small. The same can be said for the number of students in vocational schools. This situation has encouraged us to try, at least regionally, to identify the factors that affect the formation of the students' attitudes in teaching and learning mathematics. In order to determine the impact of various factors that influence in students' attitude about mathematics, a survey is conducted. This survey is conducted on a sample of students from fourth class at secondary schools in Stip, before they make a decision for their next education.

Similar research was made in [12] for the students in primary schools.

The objective of the research is getting information about students' attitudes in teaching mathematics. For achieving the goal, we had determined several tasks:

1) Is the gender of the student, factor in the formation of positive / negative attitude?
2) Does the grade of mathematics / computer science from previous year affect the formation of positive / negative attitude?
3) Does the grade of mathematics / computer science from half year affect the formation of positive / negative attitude? (In the context of this task, we did not decide to

conduct a test of knowledge, but we based on the grade given by the teacher.)

4) Does the method of implementation of mathematics by the teacher influences the formation of positive / negative attitude?
5) Does the teacher's personality affect to the formation of positive / negative attitude?
6) Does the attitude towards mathematics influences the choice of students' future education?

This is a quantitative study, which explores secondary students' attitude towards mathematics in a selected secondary school in Stip.

Questionnaire for measuring attitude toward mathematics of students in secondary school was constructed for the purposes of this research. The survey had several sets of questions. Questions relating to the assessments that students have in mathematics, questions about their choice of future education, issues related to the way of teaching by their mathematics teacher, questions that express their own attitude about mathematics, questions related to the way that solve the problems faced during the study of curricula in mathematics and issues related to their engagement in mathematics out of the school.

The results of the survey were processed with statistical software SPSS 21. For determining the influence factors, factor analysis was applied. In addition, the strength of the connections between various factors was calculated.

In the survey, 187 students from the secondary schools in Stip were examined. There are 103 male and 84 female students. They were from a wide range of social and economic backgrounds. Data used in this study were collected at school. Letters describing the study were sent to the parents who gave their written consent to the head teacher. Questionnaires were administered in the classroom under the supervision of a member of our research team.

III. Results and Discussion

In the research the descriptive statistics of participants' attitudes, motivation and perceived social support towards mathematics, and their differences considering gender, grades are presented. By using the parametric statistics, more research hypotheses have been checked. One factor analysis ANOVA is applied, also.

TABLE I.

Group Statistics					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
Attitudes	Male	103	71.5825	19.83882	1.95478
	Female	84	73.5833	23.17467	2.52856

55,1% of respondents are male and 44,9% are female. The subjects were students in two secondary schools in Stip. 55.1% are from Kole Nehtenin (vocational technical school), and 44.9% are from the high school Slavco Stojmenski. In the survey 89.8% reported that they would continue their education at some faculty and 10.2% that they will not continue their education. 5.9% said that they would continue on natural and mathematical sciences at the university, 45.5% on technical sciences, 29.4% on social sciences, 4.3% at art and 5.3% at medical sciences at the university.

Regarding to the reliability of the instrument, the coefficient of internal homogeneity Cronbach's alpha was 0.93 and it can be concluded that the internal consistency of the whole instrument is solid (Cronbach's alpha is larger than 0.90).

In order to determine, if there is any correlations between the students' attitude and the students' gender, we apply Student's t-test. By using t-test we can compare the means of these two samples even if they have different numbers of replicates.

We applied the t-Test for independent groups, the male students (M = 71.58, SD = 19.84) and female students (M = 73.58, SD = 23.17) in terms of attitude for mathematics. From the table 2, the value of the t-Test $t(97) = -0.636<1.433=F$, $p > 0.05$, so it can be concluded that there are no differences between students' gender and attitude for teaching mathematics.

TABLE II.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Attitude towards mathematics	Equal variances assumed	3.556	.061	-.636	185	.526	-2.00081	3.14611	-8.20767	4.20605
	Equal variances not assumed			-.626	164.147	.532	-2.00081	3.19606	-8.31149	4.30988

According to the results which were obtained by application of t-test, there are differences between students from vocational school and students from the high school, in terms of attitude towards mathematics, *t* (159,904) = - 4.39, *p* < .001, the students from high school Slavco Stojmenski (M = 79.86, SD = 22.48) have more positive attitude toward mathematics, than students form vocational school Kole Nehtenin (M = 66.47, SD = 18.44). That means that the null hypothesis is declined and the research hypothesis is accepted. The Levene test for equality of variances is important F(159,90) = 7,64, p< 0,001), that means that the assumption for equal variances of the groups is impaired, according the degrees of freedom are moved from 185 to 159,904. (Table 3)

TABLE III. **INDEPENDENT SAMPLES TEST**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Attitude towards mathematics	Equal variances assumed	7.648	.006	-4.476	185	.000	-13.39112	2.99171	-19.29337	-7.48887
	Equal variances not assumed			-4.388	159.904	.000	-13.39112	3.05209	-19.41872	-7.36353

One factor analysis ANOVA (table 4) showed that there are not differences between students who have different choice for the next education in terms of their attitude towards mathematics F(4,164) =13.36, p < .001 It follows that a positive attitude towards mathematics does not depend on the choice for next education.

TABLE IV.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19377.634	4	4844.408	13.358	.000
Within Groups	59478.366	164	362.673		
Total	78856.000	168			

According the results which were obtained by application of t-test, the students who replied that they will continue their education (M =74.15, SD = 21.71) have more positive attitude towards mathematics then the students who finished their education on secondary level (M = 57.68, SD =9.40), *t*(44.48) = 6.03, p<.001. The Levene test for equality of variances is important F(44.481) = 19.073, p< 0,01, that means that the assumption for equal variances of the groups is impaired, according the degrees of freedom are moved from 185 to 159,904 (table 5).

TABLE V. INDEPENDENT SAMPLES TEST

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Attitude towards mathematics	Equal variances assumed	19.073	.000	3.267	185	.001	16.47055	5.04193	6.52348	26.41762
	Equal variances not assumed			6.030	44.481	.000	16.47055	2.73127	10.96773	21.97338

For determination of the relationship between attitude towards mathematics and grade in mathematics from the previous year among students of secondary school, non-parametric test was applied (Spearman's rho coefficient), because the variable-grade in mathematics from the previous year is measured on ordinal level. According to the data of a statistical correlation analysis it can be concluded that there is distinct difference between attitude toward mathematics and mathematics assessment of the previous year (r = 0.64; p <0.001). Students who had higher grade in mathematics in previous year, have a more positive attitude towards mathematics, i.e. with increasing success in mathematics, attitude of positivity in mathematics is increased (table 6).

TABLE VI. CORRELATIONS

			Mathematics' grade from previous year	Attitude towards mathematics
Spearman's rho	Mathematics' grade from previous year	Correlation Coefficient	1.000	.636**
		Sig. (2-tailed)	.	.000
		N	187	187
	Attitude for mathematics	Correlation Coefficient	.636**	1.000
		Sig. (2-tailed)	.000	.
		N	187	187

**. Correlation is significant at the 0.01 level (2-tailed).

According to the results of the statistical correlation analysis there is significant relationship between attitude towards mathematics and grade in mathematics on a half year (r = 0.68; p<0.01). The students who had better grade in mathematics at half year, have positive attitude towards mathematics, i.e. with increasing success in mathematics, positivity of attitude in mathematics is increased (Table 7).

Table VII. CORRELATIONS

			Assessment in mathematics from half year	Attitude towards mathematics
Spearman's rho	Assessment in mathematics from half year	Correlation Coefficient	1.000	.679**
		Sig. (2-tailed)	.	.000
		N	187	187
		Correlation Coefficient	.679**	1.000
		Sig. (2-tailed)	.000	.
	Attitude towards mathematics	N	187	187

**. Correlation is significant at the 0.01 level (2-tailed).

There are many studies which have explored the role of the environment on learning. Students get maximum learning and develop positive attitude toward a subject in a climate where student get higher involvement, teacher-student relationship, and creative teaching methodology. In order to provide maximum learning, there should be an environment, where student feel comfort, motivation, and experimentation in the classroom. Attitude has positive impact on student motivation, it eventually generates fruitful results. Even 42.2% surveyed students said that they have performance anxiety in mathematics always and 18.2% are always afraid to answer the question that is posed by the teacher. When they face up with a problem related to mathematics, even 53.5% of the surveyed students always ask their parents to hire a private teacher, 25.7% always retreat hoping to get lucky, and only 10.7% always seek help from a mathematics teacher at the school. On the other side, only 4.8% of the students said that the mathematics teacher always says what is important on the class and even 23% said that the teacher never emphasizes the important things during the class. 12.3% of the surveyed students said that the teacher does not encourage discussion and 63.6% said that teacher always leaves them to solve the problems alone while he does something else. Only 7.5% said that teacher compares what they learn on the class with the real problems in their lives. Also the results from the survey show that the mathematics teachers always use the books-3.2%, but only 12.3% always use computer software.

IV. CONCLUSION

It could be concluded that the students' attitude towards mathematics does not depend on the student' gender. In addition, positive attitude towards mathematics does not depend on the choice for next education. However, the attitudes towards mathematics depend on their achievement in mathematics. The teachers should focus to increase the level of achievements in order to foster optimistic attitude.

These data indicate that mathematics teachers should seriously think about introducing changes in the process of teaching mathematics. Teachers should make changes in their approach to the students, in order to eliminate fear among the students and to provide a pleasant climate for working.

We will give a recommendation for the teachers for greater use of the computers in teaching mathematics, in order to allow visualization for the students, and connecting mathematics with real situations.

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MULTIVARIABLE DATA ANALYSIS (MVA) FOR MORE STATISTICAL METHODS IN THE SAME TIME INTERVAL

A. Krstev, K. Runcev, B. Krstev
University of Goce Delcev – Shtip, Republic of Macedonia
aleksandar.krstev@ugd.edu.mk, boris.krstev@ugd.edu.mk, kostadin_runcev@yahoo.com

Abstract - By implementing the system analysis and monitoring of water resources would allow an easier way of getting accurate, timely and reliable data related to water resources. With the help of this system enabled easier way of supplementing the database obtained from the fieldwork and processing of the office. Video monitoring is a major step in the monitoring of water resources especially in periods when there is increased water level so there is a danger of flooding. The data is processed by using this computer system may be used by other institutions, but still need their approval. With the help of new modern technologies and use the applications easily enables data to be modified, supplemented and stored.

The program for statistical analysis Minitab is composed of one main menu which offers a huge range of tools for statistical analysis. The study of the decision other than numerical, tables can be displayed graphically. This program is utilized in order to calculate factor analysis and to show Final Solutions.

In order to analyze multiple scenarios used multivariable data analysis (MVA) which includes monitoring and statistical analysis of multiple processes are processed in the same time interval. With the help of this analysis all variables are used as independent in order to analyze further alternatives in choice of final conceptual solution. With the help of this analysis to identify and critical parts of the analysis in order to calculate the effects of variables that are used in complex systems. This research used factor analysis for decision. The factor analysis with the help of this program is implemented with the help of scenarios. IT system is assayed with 3 scenarios.

I. INTRODUCTION

In order to analyze multiple scenarios used multivariable data analysis (MVA) which includes monitoring and statistical analysis of multiple processes are processed in the same time interval. With the help of this analysis all variables are used as independent in order to analyze further alternatives in choice of final conceptual solution. With the help of this analysis to identify and critical parts of the analysis in order to calculate the effects of variables that are used in complex systems. This research used factor analysis for decision. The factor analysis with the help of this program is implemented with the help of scenarios. IT system is assayed with 3 scenarios.

In this project using the program Minitab 17 will be analyzed data on water bodies in the State Macedonia. All water bodies that are analyzed are fictional, and the data used to analyze which would help in the use of these applications that would facilitate the daily work and access to data.

II. MINITAB SOFTWARE PROGRAM TO FACTOR ANALYSIS

In order to realize the phases of the factor analysis will be used software program Minitab. Minitab has been created by Barbara Ryan, Thomas Ryan and Brian Joyner of Pennsylvania State University in the US in 1972. Today, the commercial product is distributed by Minitab Inc and has great use.

The advantages offered by this software program are:

- Easy to use and use - the use of Minitab is not necessary knowledge of a complex language. All regular statistical functions can be performed using Minitab with one or a few clicks of a drop-down menu. In addition, the menu is organized in a very good intuitive way, so it's hard to remember what is where. All these features make Minitab available for those customers who first time use;
- Great functionality - a large amount of statistical functions can be performed with this program, including all basic simple statistics, to more complex data. However this program contains many tools that can be used to control the process, including methods of analysis, graphics, design of experiments, etc. Also the use of this software is great by many companies worldwide and across all industries and
- An accurate display of output data - most Minitab users are particularly impressed by the graphics output of this program.

Minitab can create many types of graphs and statistics are easily displayed and pictorial results after processing.

The following figure shows the layout of the software program:

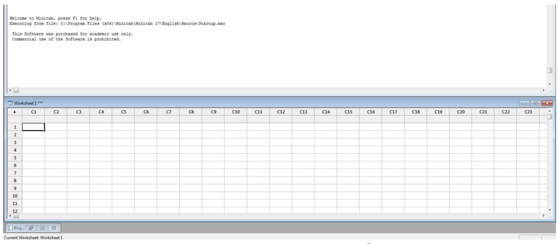

Figure 1. Minitab

This program for statistical analysis Minitab is composed of a main menu offers a large selection of tools for statistical analysis. The display solution than numerical, tabular can display and graphics. This program is used to calculate the factor analysis and display finishing solutions.

In order to analyze multiple scenarios used multivariable data analysis (MVA) which includes monitoring and statistical analysis of multiple processes are processed in the same time interval. With the help of this analysis all variables are used as independent in order to analyze further alternatives in choice of final conceptual solution. With the help of this analysis to identify and critical parts of the analysis in order to calculate the effects of variables that are used in complex systems. This research used factor analysis for decision. The factor analysis with the help of this program is implemented with the help of scenarios. IT system is assayed with 3 scenarios.

A. *Scenario 1 - Analysis of financial feasibility*

In this part of the project to analyze all the data and factors related to finance.

Analyze the following 7 variables:

1. Costs for implementing the system;
2. Testing of the system and its use;
3. Monitoring and its implementation;
4. Connect the system and its financing;
5. Additional costs;
6. Utilization of the system;
7. Recovery use.

The table that is needed for the analysis of all the features of information system, analyze all these variables with characteristics 1-5. 1 is a minimal assessment of the situation (poor), while 5 is the largest and best value in the assessment (excellent condition). The analysis is made for one year (12 months).

1. alarming situation;
2. Unsatisfactory condition;
3. Good condition;
4. Satisfactory condition
5. Excellent condition.

TABLE 1. ANALYSIS OF FINANCIAL FEASIBILITY

Month	V1	V2	V3	V4	V5	V6	V7
1	4	3	1	3	2	1	3
2	2	3	2	4	4	1	3
3	3	3	1	3	2	1	3
4	4	2	3	4	5	2	4
5	5	3	2	4	5	2	4
6	3	2	1	4	5	2	5
7	2	4	2	3	5	3	5
8	1	4	1	2	4	2	2
9	2	2	3	4	5	2	1
10	2	2	3	3	4	2	2
11	3	3	3	4	3	3	3
12	4	4	1	2	4	3	4

The table with the help of the program are analyzed 3 main factors that will be used in further financial part of implementation, such as:

1) Timing of implementation;
2) Application of new methodologies and
3) financial savings.

The obtained results multivariable analysis are shown in the following table:

TABLE 2. RESULTS FROM SCENARIO 1

Variable	Factor 1	Factor 2	Factor 3
C1	0,099	-0,133	-0,544
C2	-0,397	0,131	0,006
C3	0,283	0,233	0,220
C4	0,389	-0,024	0,162
C5	0,102	0,442	-0,010
C6	0,139	0,534	0,023
C7	-0,071	0,157	-0,512

With correlation of data for the first factor No. 1 timeline for implementation, the greatest value is obtained when analyzing the variable number 2 Testing of the system and its use -0.397. To test the system and its successful use requires a period of time that would meet required goals and thus would and spend more money. Factor No. 2 Application of new methodologies is the largest variable number 6 Utilizing the system and amounts to 0.534. If the system is used correctly it is possible to implement new application systems and technologies more advanced and proper distribution of data. Financial savings of implementing the system mostly depends on the variable number 1, costs of implementation. The factor number 3 is -0.544. If we reduced costs for this system so the savings will be greater.

The period of time for implementation, and saving the system depends on the period of testing and use. The application of new methodologies dependent on the utilization of the system and its daily need and if we have lower costs will have more savings from the system.

B. Scenario 2 - Computer System for Water Resources Management

In order to analyze all types of water resources and to monitor their status Monitoring analyzed factors that would affect the implementation of a computer system. In this scenario analyzed 6 variables that are associated with the computer system and are used to implement:

- Availability of the system and its use;
- Period of utilization;
- Daily use;
- Quality in using the system;
- Video surveillance and
- Availability of data.

Matrix factor analysis of the lights is shown in the following figure:

TABLE 3. COMPUTER SYSTEM FOR THE ANALYSIS OF WATER RESOURCES

Month	*V1*	*V2*	*V3*	*V4*	*V5*	*V6*
1	4	2	5	3	2	3
2	3	2	5	3	4	2
3	5	2	5	3	2	4
4	4	3	4	3	5	4
5	4	3	4	4	5	3
6	5	4	3	5	5	4
7	4	4	4	5	5	3
8	5	5	3	5	4	4
9	3	3	5	5	5	5
10	2	3	5	3	4	5
11	2	2	3	3	3	4
12	1	2	5	3	4	5

Correlation factors used three months of the year are chosen at random. Here we are used three factors needed for multivariable analysis as follows:

1) Data transfer and exchange;
2) critical points for the detection and
3) Field analysis of monitoring sites.

The obtained results multivariable analysis are shown in the following table:

TABLE 4. RESULTS FROM SCENARIO 2

Variable	Factor 1	Factor 2	Factor 3
C1	0,441	0,290	0,259
C2	0,300	-0,139	-0,106
C3	**-0,442**	-0,188	0,170
C4	0,178	-0,274	-0,011
C5	-0,314	**-0,792**	0,147
C6	0,174	0,178	**-0,892**

From the resulting factor analysis can be noted that the transfer of the data and their timely delivery depends on the use of various places and institutions (daily use) -0.442, monitoring data and water resources is needed most critical points for monitoring and analysis - factor -0.792. The availability of data that can be used in this system depend from the field analysis of the sites and the availability of places in the analysis - 0,892.

C. Scenario 3 – Opinion of citizens in Macedonia- Survey

The latter scenario which analyzes the project involves examining the opinion of the population of Macedonia. Placed 6 issues for which 10 citizens give opinions related to water and water resources in Macedonia. The assessment of the replies and opinions of the citizens is the same as in the previous scenarios, with a limit of 1 to 5. The questions that are posed to the survey are:

- Do you need IT system for management of water resources?
- How do you assess the current state of water?
- How do you assess the quality of the water supply?
- Your assessment of health services?
- Is protected water and its quality?
- The required water monitoring?

All replies received from 10 polled are shown in the following matrix.

TABLE 5. SURVEY

Month	*V1*	*V2*	*V3*	*V4*	*V5*	*V6*
1	4	2	3	3	3	4
2	5	1	3	3	4	4
3	4	2	4	3	3	4
4	5	1	3	2	3	5
5	5	2	3	2	3	5
6	4	1	2	3	3	4
7	5	1	3	2	2	5
8	4	1	2	2	3	4
9	5	2	2	2	3	4
10	3	2	2	3	3	5

3 months of the year are used to analyze factors. We used three factors, namely:

1) Water purification stations;
2) Uniform distribution of water resources and their supervision and
3) Protection of nature and environment.

The obtained results multivariable analysis are shown in the following table:

TABLE 6. RESULTS FROM SCENARIO 3

Variable	Factor 1	Factor 2	Factor 3
C1	-0,062	-0,519	-0,326
C2	0,178	0,490	-0,301
C3	-0,025	0,030	-0,787
C4	-0.282	0,326	-0,061
C5	-0,505	-0,143	-0,070
C6	0,469	0,091	-0,070

According to respondents purification stations for water needed for better protection and water treatment -0.505, IT system is needed to ensure an equitable distribution of water resources and their detailed supervision -0.519 and environmental protection would have better water quality and its pollution would be less -0.787.

III. SWOT ANALYSIS

- Benefits - By implementing the system analysis and monitoring of water resources would allow an easier way of getting accurate, timely and reliable data related to water resources. With the help of this system enabled easier way of supplementing the database obtained from the fieldwork and processing of the office. Video monitoring is a major step in the monitoring of water resources especially in periods when there is increased water level so there is a danger of flooding. The data is processed by using this computer system may be used by other institutions, but still need their approval. With the help of new modern technologies and use the applications easily enables data to be modified, supplemented and stored.
- Weaknesses - disadvantages that may arise in the implementation of the system would be mostly financial perspective. If institutions are planned to use the system are not able to support the system with data exchange, permission to access or CCTV then be a problem in its proper use. All institutions need to cooperate for the timely exchange of data and upgrading. Also part of the staff who would work on this system from different institutions in the country should be trained in its proper use. As long as some employees do not gain retail experience can be lost in time.
- Opportunities - The opportunities offered by this system is the easy access to information that can be entered from the field, modifying their timely exploitation. This system would have devoted more attention to water resources and their distribution and monitoring.

Staff working in this area have the opportunity to use new applications and to use new tools.

- Threats - threats that may emerge in the modernization of this system are: blockade of the system and its availability (system crash), lack of access to data, sites inaccessible terrain, time delay in implementation.

IV. OPPORTUNITIES OFFERED BY THE SYSTEM

- Ability to analyze water bodies
- Possibility to change the attributes in the database
- Data entry and changing them
- Monitoring of monitoring sites
- Easy access to the database login
- Ability to print the data
- Setting the pictures of measuring points and their printing
- Display coordinates of locations
- Identification of parameters
- Search Data

V. CONCLUSION

In order to analyze multiple scenarios used multivariable data analysis (MVA) which includes monitoring and statistical analysis of multiple processes are processed in the same time interval. With the help of this analysis all variables are used as independent in order to analyze further alternatives in choice of final conceptual solution. With the help of this analysis to identify and critical parts of the analysis in order to calculate the effects of variables that are used in complex systems. This research used factor analysis for decision. The factor analysis with the help of this program is implemented with the help of scenarios.

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INDEPENDENT LEARNING AND MODERN EDUCATION TECHNOLOGY

E. Eleven*, D. Karuović*, M. Pardanjac*, A.Lunjić**
*University of Novi Sad, Technical Faculty "Mihajlo Pupin" Zrenjanin, Republic of Serbia
**Primary school Bosko Strugar, Ulcinj, Montenegro
erika.eleven@tfzr.rs, aruena@tfzr.uns.ac.rs, marjana.pardanjac@tfzr.rs

Abstract - This paper points at the importance of educating young people for qualitative information usage from the Internet. The review of abilities and skills incorporated in information literacy is presented, which helps in illustrating the role of independent learning skills in this type of literacy. Independent learning skills, e learning, distance learning as well as life-long learning are all based on information literacy. Electronic learning (e learning) and distance learning (UND) enable users to attend some of the offered educational courses that can be found on web sites of educational institutions. The review of distance learning, a forerunner of web-oriented learning, is presented as well. It is also described a development process of contemporary educational technology which follows this type of learning. Finally, the most important notions related to distance learning and modern information technologies are explained as well.

I. INTRODUCTION

The Internet has introduced new terms for learning, learning via web, or online learning. Online learning is classified as a general term, related to learning by the help of a computer and the Internet. The levels of such learning are various, starting from basic programs that include texts and the course graphics, exercises, tests and tests results. Some of them include animations, simulations, audio and video sequences of discussion groups with peers and experts, online tutorial, links for materials on the Internet or web as well as other educational resources (Urdan & Weggen, 2000).

Together with online learning, the term online education has also been made. Online education enables studying advanced education courses via the Internet. All course materials including documents, contacts with tutors and colleagues may be accessed via personal computers and telecommunications.

Online education offers students freedom to study virtually in any location and in tempo, which could be adjusted to their own conditions, work and families (Kearsley, 1999).

Electronic learning assumes learning in which computer web is used for information distribution, interaction and improvement of the learning process. Within the learning based on new technologies, it is important to mention resource-based learning, too. This term has become popular partially because it reflects new trends and progress and because it serves as a concept which covers the terms such as open learning, flexible learning, individual learning, and computer aided learning and project based learning.

Time and location independence, great volume of resources and dynamic contents nature have made the Internet a great potential for learning.

Students who acquire knowledge at universities all over the world have already had certain subjects, which they study via the Internet, or online. Most employed people, as well as those who live far from universities enroll online courses organized by universities and colleges, [2].

Because of fast development of technologies, the accepted concept of adults' education and permanent life-long learning represents one more element that supports the necessity for implementation of a modern way of distance learning.

Distance learning according to definition of "United States Distance Learning Association" (USDLA): "Distance learning is assimilation of knowledge and skills through indirect methods of informing and education comprised by various technological and other types of distance learning" [7].

II. PROGRAMS AND COURSES

Education, traditional or based on Web, involves the work of experts for organizing contents, sequences of teaching activities, the structure of tasks, a set of interactions and the process of evaluation (Harasim and others,1995).

The course, which is designed or adopted to be delivered via Web, is delivered to different surroundings from a traditional classroom and because of that, the designed process imposes respecting the following pedagogical steps, including the need for:

- changing the role of an instructor going from a teacher to an assistant or a process guide,
- leading students through non-linear, hypermedia surroundings which enables making knowledge and meaning in a new way,
- building feelings for class community and strengthening learning by building-in collaborative elements,
- providing an academic integrity.

Virtual classroom is a medium, which possesses its unique characteristics contributing to selection of appropriate pedagogy (McCormack & Jones, 1998).

Another critical factor that can contribute to effective on-line learning is the Class Web Site. The Class Web Site provides an organizational structure convenient for students' engagement in the work with course material and for teamwork (Palloff & Pratt, 1999). Making materials for Web differs from making printed materials because Web has more senses (Porter, 1997).Web project must be readable, informative and it must have clear conceptual and intuitive lanes through parts of information. Customers want navigation on Web site, which will not cause confusion (Hall, 1997). The more interaction there is on Web site the easier students will understand the course contents (Porter, 1997). Many authors agree that interaction represents a significant component in the teaching program. It is a means for learning (Hall, 1997). It is the key element of successful courses and students should use it efficiently in order to achieve the aims of learning and become satisfied with the achieved experience. Interactions in on-line learning are strengthened by specially designed tools for incorporating interaction in virtual classroom, for suggestions concerning access to learning in Web environment, identification and selection of specified activities, which are serving well in on-line surroundings. Every tool offers specific opportunities and it has its requirements, which make it appropriate only for a certain purpose (McCormack & Jones, 1998).

III. TYPES OF ACADEMIC PROGRAMS

Academic programs for on-line learning, except those on virtual universities, are always realized partially in traditional classrooms (face-to-face). If 80% of the program contents are realized via Web, these programs are considered on-line programs (The Sloan Consortium, 2005). If the contents delivered via Web include 30...79% of the whole program then such programs are called blended / hybrid programs; along with blended / hybrid programs the name blended / hybrid learning is also used.

A. Blended learning

Development of information and communication technology has brought fast changes in education. The first experiences with these technologies have revealed possibilities for better quality of learning, its efficiency, adaptability and prices. It is obvious now that learning experiences will evolve and become "blended" combinations of traditional methods and learning methods based on technology (Singh & Reed, 2001).

Blended learning represents one of leading trends of current education; it is a combination of electronic learning and traditional learning in a classroom and its aim is achieving maximum learning effectiveness. Blended learning includes the best parts of electronic and traditional learning in order to achieve flexible, price acceptable education and training that can be accessed by wide public both geographically distant and different concerning learning styles and the level of education (Clark, 2003).

The key for blended learning is a selection of the right combination of media, which will lead to optimum solution. Components of online media can be combined with components of offline media (traditional classroom).

Offline components of blended learning can be classified in six groups:

1. Individual learning (at home, at work place);
2. Learning with the help of tutor, instructor or mentor;
3. Classroom learning (lessons, laboratories, seminars);
4. Printed media (textbooks, practicum, journals);
5. Electronic media (audiocassettes, audio-CD, video tapes, CD-ROM, DVD);
6. Radio-TV (TV, radio, interactive TV).

Online components of blended learning can also be classified in six groups:

1. Online contents for learning (simple and interactive resources for learning);
2. Electronic tutor, instructor or mentor;
3. Online collaborative learning (e-mail, mail lists, chatting, virtual classroom, audio-conferences, video-conferences);
4. Online knowledge management (data browsing, making documents);
5. Web (browsing machines, Web- sites, users groups);
6. Mobile learning (laptop, mobile phones).

At designing blended learning, we should take care about planned learning achievements, students, their culture, available resources for learning, electronic infrastructure, the extent and possibilities of servicing the proposed solution. [2]

IV. SOFTWARE PLATFORMS FOR DISTANCE LEARNING APPLICATION

Most tools for distance learning (courseware) have a module for preparation, delivery and processing tests online. If such courseware for delivering educational surroundings are used it is normal to use its own tools for online tests, as well. There is no need to buy expensive tools for distance learning if they will not be used completely. If only online tests are needed, then the selection of some sort of open source (free) courseware with a developed module should be considered. The great advantage is that it may be adjusted to needs. The best known platforms will be individually described here.

MOODLE is an acronym of Modular Object Oriented Dynamic Learning Environment. It is a verb which describes the process of an easy pass through a certain material, trying to work only when the student want to (or must), enjoying in the work that leads towards deeper creativity and knowledge.This verb describes best the origin and development of Moodle system as well as the way the students and teachers may use to access to educational process in distance learning.

Moodle is available as software of the open code (under GNU Public License). In fact, it means that Moodle is protected by copyright but it has some additional freedom. It is allowed to copy, use and change Moodle under the following condition – to enable the others the accession to the open code; original license or information about copyright will not be changed or removed and that the same license will be applied to any solution.

Moodle will operate on any computer which can start PHP and which supports some of better-known databases.

Moodle is a flexible and fast open source tool. It has a support for two bases: MySQL and PostgreSQL. It also has a support for a great number of languages. Great popularity of this tool is based on a simple and fast installing, small requirements concerning computers on which it is performed and on simple integration in the existing systems.

This tool has quickly gained a great popularity among teachers because of its pedagogical features and adjustability to academic environment. Although it has smaller possibilities than commercial tools, it satisfies a great number of users who can become easily and fast familiar with these tools.

WebCT is a programming tool used for distance learning or as an addition to classical courses and traditional education. It uses multimedia possibilities that WebCT and Internet technologies enable.

WebCT is one of the best tools for e-learning. It is fairly intuitive for work and possesses a great number of functions. It contains numerous additional tools for help in learning (links, audio, video, dictionary...) and a great number of tools for communication as well.

The program enables a teacher to make certain changes on the course at any time. These changes may or need not be visible to all students. The access to WebCT courses is authorized. Every attendant or a teacher has his/her user name and password for accessing WebCT.

One of rare tools which except WYSIWYS (What You See Is What You Get) editor possesses an editor for formulae. Support for creation and evaluation of knowledge is excellent as well as statistic review of achieved results.

WebCT enables:

- enriching the course by multimedia elements (sound, picture, Internet links, additional information...)
- evaluation of students’ knowledge by online tests and tasks
- self-estimation of knowledge
- creating index and a dictionary of important notions that appear in lessons

- communication of students among themselves and with a teacher via forums (discussions) or chat.

The advantage of WebCT-a is in the field of mathematics because it has a qualitative program for easy input and change of mathematical formulae and a quiz that accepts mathematical functions and generates questions on account of them.

a Tutor is open source Learning Content Management System (LCMS) designed for needs of adjustment and availability. Administrators can simply install or upgrade aTutor in only few minutes. Instructors can quickly collect teaching content, incorporate it in the package and distribute it online or input already the existing one. Students learn in adaptable environment.

It is simple and intuitive tool, which requires minimum time for getting used to work. The main advantages are compatibility with SCORM format, speed, availability and easy installation and maintenance.

There are many disadvantages and some of them are:

- The authors of materials cannot put multimedia on the course pages;
- Too general support for multimedia and video conferences;
- There are no private forums;
- Students cannot download their answers and tasks or exchange data with other students;
- There are no students' groups;
- Knowledge tests do not offer enough possibilities.

Despite current disadvantages, which will probably be reduced in some future versions, a Tutor is a decent open source courseware. Tools for testing and correction are within the list of tools for management. The main task of this courseware is creation of on-line tests and quizzes whose aim is practicing and knowledge check.

At Technical Faculty, "Mihajlo Pupin" a Tutor has been studied in details and the user interface has been translated in Serbian [3].

AHyCo (Adaptive Hypermedia Courseware) is an adaptable hypermedia LMS or a system for e-learning. AHyCo has basic characteristics of adaptable systems:

- it is based on hypermedia,
- it contains domain models which describes the structure of knowledge within the learning field,
- It contains the user model for storing student's characteristics,
- It is possible to adapt the parts of the system on the grounds of information in the user model.

Adaptability of AHyCo system is implemented by adjustment of hyperlinks and by the help of adaptable series of the learning contents. The system tries to limit students' free movements as little as possible through the learning contents but it directs and leads, in the same time, students towards knowledge acquisition. The first version of AHyCo system has supported only interaction between students and the learning contents by the help of adaptable hypermedia and on-line tests.

IBM Workplace Collaborative Services is professionally business oriented LMS. It is coordinated with all current norms for data exchange and it is delivered with progressive program of intuitive interface for input and arrangement of course contents. The courses can be organized in other programs, which are adjusted to the norms as well. The very content cannot be arranged directly by web interface.

Besides the great number of complete work reports and success of individual students, it is possible to make conclusions about business progress qualitatively. This LMS could be expended additionally independently by the use of available and well-documented API invitations and, in this way; it can be adjusted to more demanding users.

This is one of rare LMS, which have in-built support for blended learning, in other words, a combination of learning in the classroom and e-learning. When deciding about the course organization it is possible to estimate, in advance, when the lessons will be organized in the classroom It is good because, in this way, a complete support for a classroom work is provided(classrooms can be reserved and necessary teaching material – notebook, projector prepared).

Claroline originates from "Classroom on line". Claroline system for learning management is a modern distance learning courseware that can help in improving teching and the way of teaching. Claroline jis convenient and intuitive courseware which satisfies numerous criteria.

Its great advantage is in the fact that it is Open Source software, it has GNU (General public licence) which enables taking original code and its adjustment to own needs. It enables numerous organizations all over the world (universities, schools, associations...) for creating and administrating courses the space for collaboration via the Internet. The courseware is multi-platform one (it is written in PHP language and it uses MySQL base), so it can be installed on Windows, Macintosh Unix, Linux and other platforms; it is used in more than 80 countries all over the world in more than 30 languages.

Progress of technologes caused developing the need for a new way of distance learning by using communiction and computer technologies. Claroline was created by a group of teachers (professors, language experts...) who respected pedagogical principles and methods in order to organize and perform the teaching process by using WWW.

The platform is very simple to use and it can be mastered in a short time and used without problems even without previous knowledge from computer field. The authors of Claroline wanted to enable teachers to master technological skills in education and pedagogy and in that way become more creative and independent in implementing pedagogical principles.

BlackBoard represents one of the best coursewares for distance learning that has appeared on the market. It is very intuitive for using and can be mastered quickly. It has an excellent support for communication within the course and is one of rare courseware which supports chat and the use of "whiteboard" at the same time.

A great progress of courseware has been noticed especially concerning creation and evaluation, knowledge testing and monitoring the work of students.

Blackboard has web page with 30 days long experimental version in which, both students and teachers can see how it looks like.

dotLRN is e-learning platform of commercial quality, developed on MIT and published under open source license. It contains a support for developing web portal and an option for managing content on web and Internet is originally included.

eLearner is a system for managing e-learning environment. It belongs to generic group under the name LMS. It is adjusted to SCORM standard. Primary orientation is managing a complex e-learning environment of corporative type and public portals. It does not have courseware for content development but it relies on specialized outer courseware. It enables:

- introducing e-learning participants in the system and organization through group membership,
- implementation of SCORM compatible interactive or passive content,
- organization of attendants, content and tutors according to classes,
- mutual communication,
- on-line teaching and testing,
- monitoring and statistic analysis of the work – individual, group and class,
- writing reports.

Eledge is Learning Management System, which provides courseware for creating on-line courses and teaching materials. Eledge secures functional equipment for creating distance learning courseware and instructions for web pages, including students’ registration, quizzes, exams, homework, evaluation, uploading data and others.

FirstClass is interesting because it is supported on all standard platforms, such as: Linux, Windows, and Macintosh.

It is divided in components Server, Client, Internet Services, Voice Services i FirstClass Directory Services. It provides asynchronous and synchronous communication to users (mail, forums, chat) as well as the exchange of data via folders and common calendars. Its advantage is in that it supports voice mail and fax and it also has wide options for accessing messages in mailbox - if voice mail is in question then it is possible to listen to it via phones or mobiles.

ILIAS is open source courseware, which has been developed thanks to reference of Austrian Ministry of Education. Although it is made by using PHP, along with additional libraries its purpose is to be performed only on Linux platform (it was tested on RedHat distribution).

Kewl was made at "University of Western Cape" with the aim to research e-Learning. Later, Kewl was used and developed in teaching, too. Kewl has basic possibilities of majority of commercial tools with the same purpose.

A great advantage of this courseware is extensive documentation and the examples of complete courses, which can be simply incorporated in it. An option concerning translation in other languages has been anticipated as well.

Manhattan Virtual Classroom is protected by password, web oriented system for e-learning which includes several different discussion groups, synchronous chat, sections in which teachers may publish materials, module for organization of on-line tasks, module for marks, surveys, private messages among course students...

V. Conclusion

The Internet is a powerful means for engaging students' cognitive activities. Individuals and groups of students can cooperate in projects, they can express their interests, taking responsibility for collecting information and within this process, and they can all communicate with their peers and with experts from all over the world. For a teacher/ instructor the Internet opens an electronic door towards resources for learning and practical experiences that could not be reached before. No matter in what extent the field of interest is specialized there is always someone on the Internet who can help in finding useful resources. Full potentials of the Internet as a means for learning are still unknown but its capabilities are unlimited.

There is a great number of different courseware and programs for distance learning on the market. Their performances are various, some are commercial and some are free. Very important elements concerning the choice for using are simplicity, smaller requirements related to hardware and software support, larger databases, openness in loading and regular communication. There are numerous advantages of tests as instruments for knowledge check within web authorized systems: independence related to the place and time of testing, smaller costs for users, possibility for self-organizing concerning the time for testing, multimedia materials, an option for test repetition, instantaneous availability of test results.

It is important to know the criteria before selecting the courseware. An attention should be paid to the fact whether it supports the standards for data exchange and the features of the relevant standards.

During the analysis, it was noticed that a great number of courseware, declared as courseware for e-education, had certain bad sides and they generally lacked a great number of possibilities. Some programs are difficult to install and are rather non-intuitive.

Prior to the courseware selection, it is necessary visit web pages of the relevant courseware producer in order to get more details about courseware performances, supported standards, user support, etc. The best advice is to try as many types of courseware as possible and then, according to the objective, make decision about the most appropriate courseware.

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METHODICAL QUESTIONS OF NATURAL AND TECHNICAL SCIENCES SUBJECT TEACHING

USAGE OF WONDERSHARE QUIZCREATOR SOFTWARE FOR ASSESSMENT AS A WAY OF IMPROVING MATH EVALUATION

D. Jovanovska[*], T. Atanasova Pacemska[*], L. Lazarova[*], S. Pacemska[**], T. Kovacheva[***]
[*]University “Goce Delcev”, Stip, Republic of Macedonia
[**]Bureau of educational development of the Republic of Macedonia
[***]Technical University – Varna, Republic of Republic of Bulgaria
dobrila.210123@student.ugd.edu.mk, tatjana.pacemska@ugd.edu.mk, limonka.lazarova@ugd.edu.mk
sanja.pacemska@gmail.com, tsetska.kovacheva@tuvarna.acad.bg.

Abstract - Checking and evaluation are one of the most important elements of the learning process, because they provide information about the extent to which students achieved previously uploaded educational standards.

This paper is a proposal how to improve the evaluation process in mathematics by using electronic tests created by multimedia software known as Wondershare quizcreator software. To make tests for computer based test, there are multiple quiz/test tools to choose from, but for the part of math features supported, QuizCreator will be a good math test tool whether from its powerful feature or ease of use. QuizCreator Online can provide elaborate results analysis by questions, score or students with tables and graphics. Electronic tests are implemented in April, year 2015. Comparison is made between students' outcomes when electronic tests are used and their outcomes gained by old- fashioned testing system pencil-paper. From the research results, we can conclude that this method of testing is very helpful to students and teachers.

I. INTRODUCTION

Checking and evaluation of students' knowledge are an integral part of the teaching process in primary education. They are one of the most important segments of the learning process, as they provide information about the extent to which students achieved previously uploaded educational standards.

The evaluation of students' knowledge and skills takes places in various ways; apply different techniques, [1], [3].

In the overall system of education, there are three main methods of evaluating students: written, oral and combined method. The written assessment method comprises a paper tests shaped "pen-paper" in all subspecies and grading so-called electronic quizzes or tests.

In this paper, we put emphasis on the development and construction of electronic tests / quizzes, their scoring and evaluation through application of the latest software developments.

Generally, tests in mathematics are designed to measure knowledge, skills and abilities of students in mathematics; teachers can realize the weaknesses of students, to evaluate the effect of teaching and learning and to improve the process of learning.

Writing effective questions takes time and practice. Well-designed tests provide an accurate measure of mathematical knowledge of students, [2], [4].

This paper covers the process of creating e- test and its implementation in April 2015 entitled System linear equations with two unknowns. The process of drafting and implementation is described.

It is made a comparative analysis of student achievement obtained by e-test and their achievements obtained by the classic paper test.

II. MULTIMEDIA SOFTWARE WONDERSHARE QUIZCREATOR

A. Basic information about wondershare quizcreator

As advanced information technology and teachers are becoming more skilled in their use, is increasing possibility teachers to apply them in the evaluation process. For assessment of students with computers there, are many free and easy for using programs that can easily fit into regular classes? A computer can be used for tests at different levels, of processing data collected through testing, to automate fully testing system. Electronic test of knowledge and skills can be automatically generated, processed and evaluated. When the results are collected, processing is performed and processing of all information.

The application of these programs to create tests is an easy way assessing to be easier and simple. In general, a math test can be conducted on paper or computer.

To create the paper test is enough Microsoft Word with its powerful math equation editor. To create so-called electronic tests, there are many tools, but for tests in mathematics best features has multimedia software Wondershare Quizcreator (fig.1).

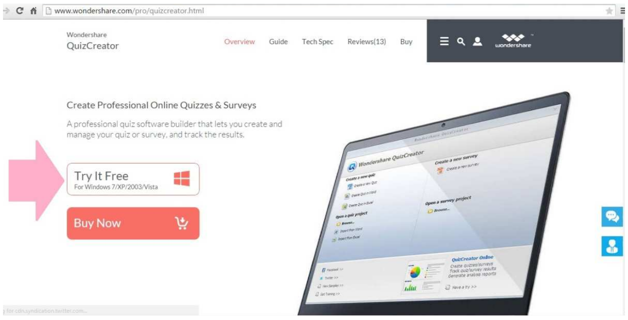


Figure 1 Wondershare Quizcreator

This excellent software allows us with a minimum work to get maximum good electronic test. This software allows electronical evaluation of knowledge, skills and abilities of students, and therefore more economical and simpler way to improve the learning process. Wondershare QuizCreator can be a comprehensive solution for teachers, teachers at the school, and working at home.

The advantages of the software relative to the other intended for the same or similar purposes are:

- Creation of questions and tasks and their organization in quizzes;
- Publishing and reporting of questions and tasks via Internet;
- Monitoring of results and their presentation with diagrams;
- Creating interactive quizzes based on simple Flash animations;
- Preparation of interactive e- tests, simple quizzes and their assessment with AICC / SCORM system in accordance with LMS (Learning Management System).

B. Creating Electronc Test

The process of creating electronic test with Wondershare QuizCreator consists of several steps:

- Installing the multimedia software;
- Registration with a valid email address;
- Creation of the test (asking questions / tasks);
- Publication of the test;
- Monitoring of the results.

QuizCreator allows easily creating of interactive multimedia quizzes / tests through nine different types of questions:

- True or false;
- Questions with multiple choices, where only one is correct;
- Questions with multiple choices, when more than one is correct;
- In addition;
- The gradual alignment;
- Connecting;
- Short essay tasks;
- Tasks with an alternative choice and;
- "Click on map" (multiple-choice questions with multiple correct answers graphically displayed on a particular tile surface).

Also in QuizCreator you can directly write mathematical and scientific formulas (which is not the case with other tools), applying the Equation editor. The test can be enriched with images, audio songs, video clips, and adding flash animation in the question itself.

Further features upon which this software apart from other, are a range of functions available to us:

- setting up an adequate number of attempts to solve the test,
- Time limit to solve the test,
- given the correct answer in background,
- Ability to skip questions, etc.

This software can be ordered online, by buying, you get a license for a single computer, but in this paper is used trial version. Installation is simple. After installation, a window that lists all options for creating electronic test / quiz or able to open someone else has already created test (fig.2).

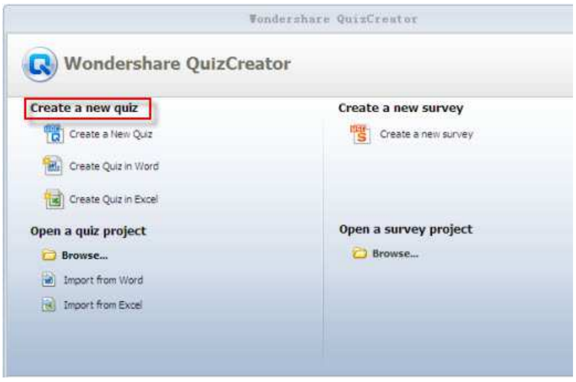


Figure 2.

After the initial page, there is a window in which on the left side is offered types of queries that can be made. After entering all the questions, window gets looks like fig.3.

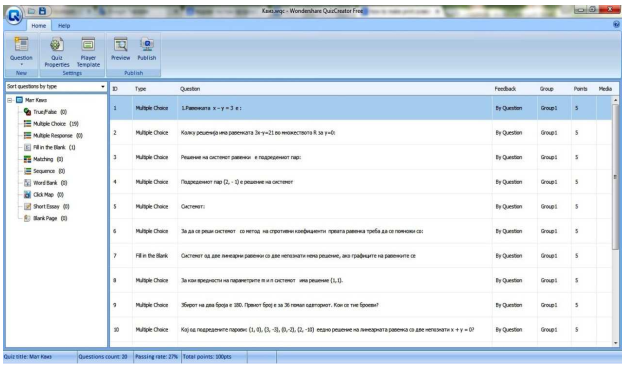


Figure 3.

In order to protect issues and to facilitate the smooth execution of the test, the student is allowed only once to solve the test with the default IP address, to adjust the duration of the test and others parameters. Once you make all settings to publish the test i.e. to export it in a document or to publish it on Internet on a server you need to click subsection Publish. The test can be shared in many kinds of files provided on fig .4

Figure 4.

The final appearance of the test is given on fig.5.

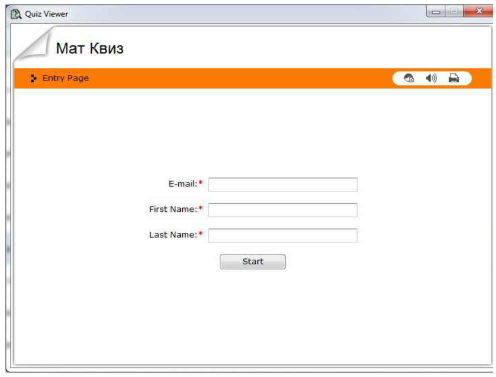


Figure 5.

C. *Implementation of the Electronic Test*

The first condition for realization and implementation of the electronic test is availability of Internet on the computers. Students register with their username and passwords given by the teacher, created by him, and starting with the test. The test consists of 20 questions with multiple choice answers of which only one is correct. Each true answer question is valued with 5 points, total 100 points. The student can pass the test with at least 27% or 27 points out of 100. To solve the test students have 40 minutes, one school class, and immediately after that period test is automatically closed. Before you pressed, the finish button students can see which questions they answered correctly, and which incorrectly. At the same time, students obtain their results and get feedback where they have made mistake and what is the correct answer.

III. Results and Discussion

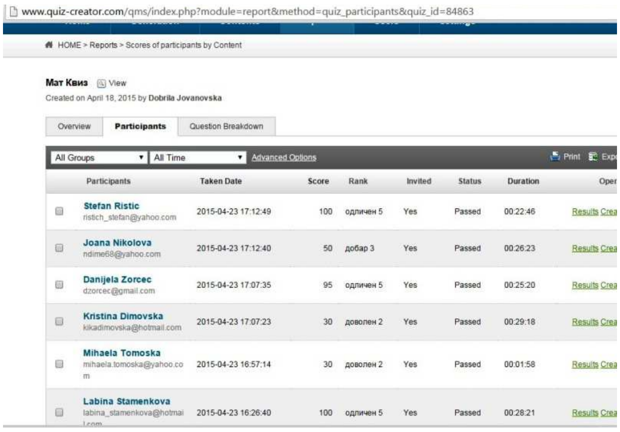
In April 2015, the knowledge of a group of 30 students on the topic: System linear equations with two unknown, were checked electronically. All of them passed the test with an average score very good (4.03). On the same topic the students were tested in March 2015 with the classic written, paper tests, with an average score good (3.03). Table 1 presents the comparative analysis of results obtained in two tests.

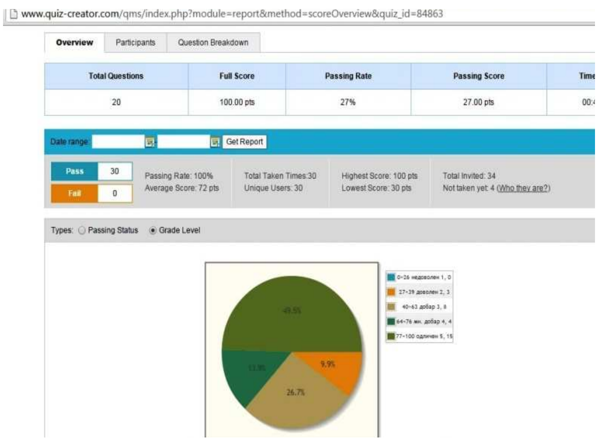
TABLE I. Comparison of results from different tests

	Traditional / classic "paper" test	electronic test
great	7	15
very good	5	4
good	6	8
pleased	8	3
dissatisfied	4	/
Number of students	30	30
Average grade	4,03	3,03

From the results in Table1 it is noticeable that all students have passed the test and the average grade was improved for 1.00%. Although the percentage of average grade is improved, still student achievement should be monitored for longer period and when it will be possible should be tested larger number of students. During e-test, performing it was noticed that sufficient time was available for going through the complete tests, all students have finished test on time, results from testing were available instantaneously, and any subjective professors' opinion was excluded enabling fair and objective grading.

After evaluation, an important role in the evaluation process has results analysis, which gives us information, details of testing that can be used for further improvement. QuizCreator Online analysis of data obtained processed immediately is descriptive analysis on answered questions and it also gives a percentage representation.





Electronic tests have become a useful tool that provides full, quick, easy and objective evaluation of pupils with complete statistical analysis of test results and the full documentation of the testing is available to monitor the further progress of the students. The analysis of test results gives you more insightful viewpoint. You can find out the weakness in students, optimize the writing of test questions, teaching methods, teaching contents and make changes, and finally optimize the learning experience and enhance the math knowledge of the students.

The main advantages of this type of knowledge assessment are:

- Checking and evaluating is fast, because data is generated immediately after its completion;
- For checking no presence of a teacher is needed;
- According to students any subjective professors' opinion was eliminate;
- Require faster response from students;
- Achieves greater savings in preparation time;
- Is more economical, the saving of material for preparation of the test;
- The number of tested students can be larger

The disadvantages of this proposed approach to knowledge assessment are:

- For implementation of this method it is necessary to invest in computer equipment;
- There is no teacher-student contact;
- Question is whether this way of testing gives the real situation of students' knowledge.

IV. Conclusion

The rapid development of computer and information technology enables improvement of old software solutions for creating electronic tests. I would recommend this software for creating electronic tests of knowledge to all the mathematics teachers.

By applying electronic testing can achieve significant time saving needed for testing and evaluation, which allows the teachers to increase test-checks, and thus improve the quality of the teaching process by enabling continuous evaluation of acquired knowledge.

Instead of traditional division of the test in several groups, electronic tests allow an individual combination of questions for each student randomly from existing database of questions, which almost completely prevents copying of answers.

The results of the individual tests are calculated quickly and easily with analysis and automatic generating of correct answers, thus providing immediate feedback with useful information about the current level of each student.

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OBTAINING FUNCTIONS FROM FOURIER SERIES WITH MATLAB

A. Stojanova, B. Zlatanovska, M. Kocaleva, V. Gicev
Faculty of computer science, "Goce Delcev" University, Stip, Republic of Macedonia
vlado.gicev@ugd.edu.mk

Abstract - Fourier series represent a very important tool for solving problems in any field of science that uses sinusoidal signals, such as engineering, physics, applied mathematics, and chemistry. Therefore, good understanding of Fourier series is crucial for the process of learning the basics of these scientific fields. The theory of these series is complicated but their application is simple. Matlab as program package is suitable for easily plotting trigonometric series and the most convenient way for understanding their characteristics. In this paper, we present a program written in Matlab that plot partial sums of three trigonometric series, as a way of finding periodic functions that series represent. We also give a mathematical proof for obtaining one of periodic functions that corresponds with our graphical representation.

I. INTRODUCTION

Mathematics is everywhere in every phenomenon, technology, observation, experiment. All its need to be done is to understand the logic hidden behind. Mathematical calculations give way to analyze results of every experiment, and can help to make precise conclusions [1].

Fourier analysis is a way of mathematics analysis that has many applications in different scientific fields like physics, engineering, microwave circuit analysis, control theory, optical measurements and also in chemistry [2] [8].

The study of Fourier series is a branch of Fourier analysis. Fourier series were introduced by Joseph Fourier (1768–1830) for solving the heat equation in a metal plate. The Fourier series and methods of numerically approximating it have been active areas of research since then [2] [3] [4].

Fourier series are used to approximate complex functions in many different parts of science and math. They are helpful in their ability to imitate many different types of waves: x-ray, heat, light, and sound. Fourier series are used in many cases to analyze and interpret a function, which would otherwise be hard to decode and understand. These series has many applications in electrical engineering, vibration analysis, acoustics, optics, signal processing, image processing, quantum mechanics, and econometrics [3] [8].

In this paper we give a brief introduction to the Fourier series as a base of different scientific fields, we present a way of plotting the series in Matlab which can be helpful for their better understanding and studying. From mathematical point of view this presentation of trigonometric series with Matlab can be helpful for easily obtaining functions from given trigonometric series, which can be more difficult problem than the reversed one i.e. obtaining Fourier series from a given function.

II. FUNDAMENTALS OF FOURIER SERIES

In mathematics, a Fourier series decomposes any periodic function or periodic signal into the sum of a set of simple oscillating functions, namely sines and cosines. In other words, Fourier series can be used to express a function in terms of the frequencies (harmonics) it is composed of [3].

In engineering and technical sciences, many practical problems gave periodic functions which are usually complex. We know that the function is periodic if it is defined for each real number x, and if there is a positive number T, called a period of f (x) i.e. $f(x+T)=f(x), \forall x$ and the smallest period T>0 named fundamental period of the function, according to [4] [5].

For simplicity and easier operation by periodic functions, we presented them with elementary periodic functions such as sine and cosine function that have a fundamental period 2π. This presentation of periodic functions like trigonometric series leads to Fourier series. Fourier series are very important practical tool because they allow the solution of ordinary (ODEs) and partial differential equations and they are more practical than development of functions in Taylor (Maclaurin) series.

The particular conditions that a function $f(x)$ must fulfill in order that it may be expanded as a Fourier series are known as the Dirichlet conditions, and can be summarized by the following points:

- The function must be periodic;
- It must be single-valued and continuous, except possibly at a finite number of finite discontinuities;
- It must have only a finite number of maxima and minima within one periodic;
- The integral over one period of $|f(x)|$ must converge.

Therefore, Fourier series of function $y = f(x)$ is defined as follows: If $y = f(x)$ is periodic and integrable function of the interval $[-\pi, \pi]$, could be expressed as the sum of a trigonometrical series of the above form

$$a_0 = \frac{1}{2\pi}\int_{-\pi}^{\pi} f(x)\,dx \qquad (0),$$

$$a_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos nx\,dx \qquad (1),$$

$$b_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin nx\,dx \qquad (2)$$

for each positive integer n.

A trigonometric series of the form

$$a_0 + \sum_{n=1}^{+\infty}(a_n \cos nx + b_n \sin nx) \qquad (3)$$

with coefficients a_0, a_n and b_n given by the integrals (0), (1) and (2) is referred to the Fourier series of the function f (x) [4] [5].

That is the way for obtaining Fourier's series from periodic functions f (x) of period 2π. The reverse way is more complicated and that is the reason why we used Matlab for plotting trigonometric series of n terms to obtain periodic functions they derived from. For good understanding of Fourier series is essential to know both ways.

III. Graphical representation of Fourier Series with Matlab

We are using three partial sums, as example to show how a periodic function can be obtained from partial sum when n is big enough to recognize a function. To demonstrate plotting of Fourier series with Matlab we will use these three partial sums:

$$\frac{1}{3}\pi^2 - 4(\cos x - \frac{1}{4}\cos 2x + \frac{1}{9}\cos 3x - \frac{1}{16}\cos 4x + -...)\_(4)$$

$$\frac{4}{\pi}(\sin x + \frac{1}{3}\sin 2x + \frac{1}{5}\sin 5x + \frac{1}{7}\sin 7x + ...)\_\_\_\_\_\_(5)$$

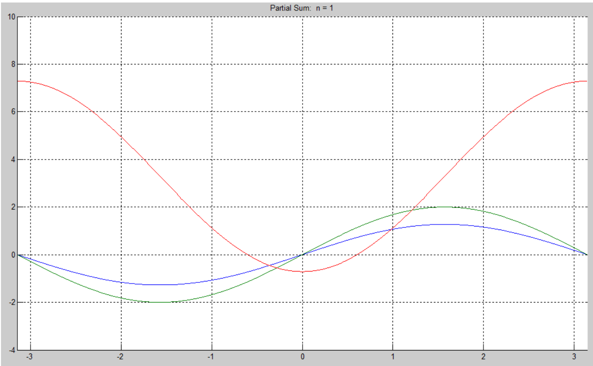
$$2(\sin x - \frac{1}{2}\sin 2x + \frac{1}{3}\sin 3x - \frac{1}{4}\sin 4x + -.........)\_\_\_\_\_(6)$$

By their graphical presentation, we will try to find periodic function that these series represent. First, we will present all three sums together in the same graphic for different n, and then we will plot separately in different graphs in order to obtain a clear view.

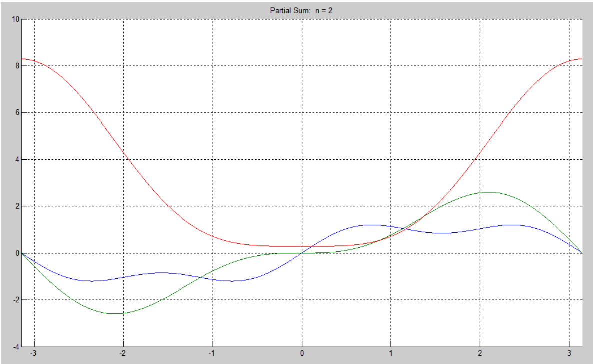
For plotting all three partial sums given in (4), (5) and (6) we are using this simple code written in Matlab.

```
x=linspace(-pi,pi,1000);
partial_sum1=0;
partial_sum2=0;
partial_sum3=1/3*pi.^2;

grid on;hold on;
axis([-pi pi -4 10])

for n=1:1:100

partial_sum1=partial_sum1+(4/((2*n-1)*pi))*sin((2*n-1)*x);
partial_sum2=partial_sum2-2/n*(-1).^n*sin(n*x);
partial_sum3=partial_sum3+(4/n.^2*cos(n*x)*(-1).^n);

handle1=plot(x,partial_sum1,x,partial_sum2,x,partial_sum3);

    title(['Partial Sum:  n = ',num2str(n)])
    pause
    set(handle1,'Visible','off');

end
```

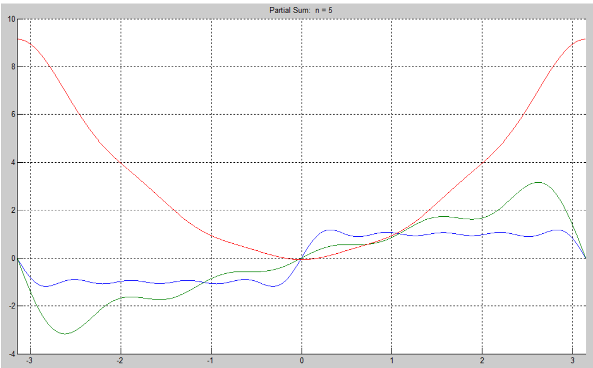
According to given code we first plot partial sums in period from –π to π, and terms n are from 1 to 100. We present partial sums for different terms. Partial sums for terms of 1, 2, 5, 21 and 100 are given in Figure 1, a), b), c), d), e).



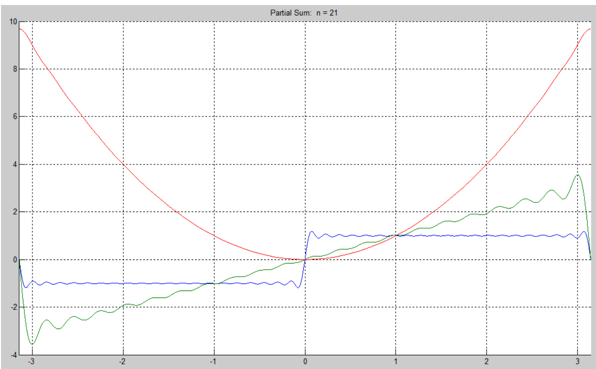
a) n=1



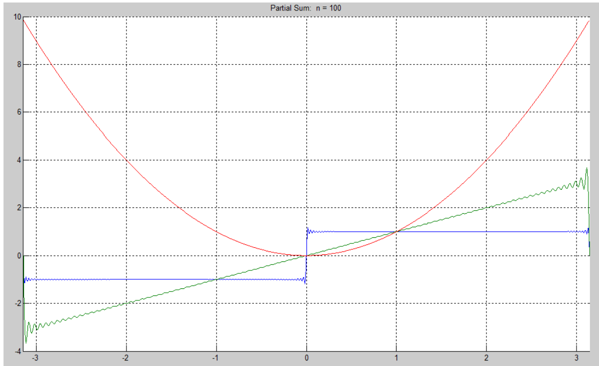
b) n=2



c) n=5



d) n=21



e) n=100

Figure 1. Graphical presentation of trigonometric series given in (4) (5) (6) ((4) red, (5) blue and (6) green curve) for n = 1, 2, 5, 21 and 100, and period from $-\pi$ to π.

From the Figure 1 is clearly seen that the larger the number of terms that are included in this series, the better the approximation to the periodic function is.

Therefore, when n are large enough we can guess the periodic functions that these trigonometric series present. According to Figure 1 partial sum (4) corresponds to periodic function $f(x)=x^2, x\in[-\pi,\pi]$, partial sum (5) corresponds to periodic function $f(x)=\begin{cases}1 & x\in[0,\pi]\\ -1 & x\in[-\pi,0]\end{cases}$, and partial sum (6) corresponds to function $f(x)=x$, $x\in[-\pi,\pi]$.

The 100-term plot gives a very good approximation to the functions, although it appears to overshoot the value at the discontinuity (and it also has some wiggles in it). This overshoot is an inevitable effect at a discontinuity, known as the Gibbs phenomenon [6]. Gibbs phenomenon can be seen in graphical presentation of partial sums (4) and (5) for large terms (in our case, n=21 and n=100).

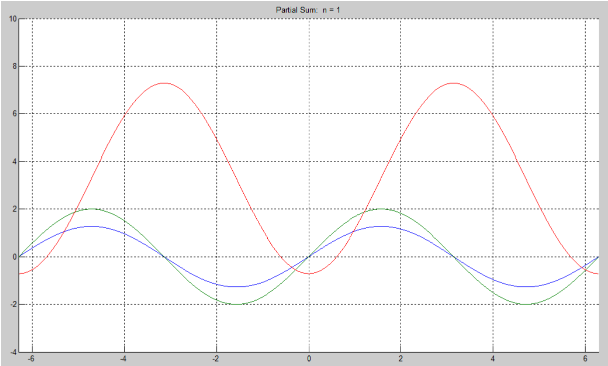
In order to obtain more clear view of trigonometric nature of partial sums and periodic nature of functions, we are presenting trigonometric series in 2T period, or x axis are from -2π to 2π. For this purpose, we change only a small piece from the code given above.

```
x=linspace(-pi,pi,1000);
axis([-pi pi -4 10])
```

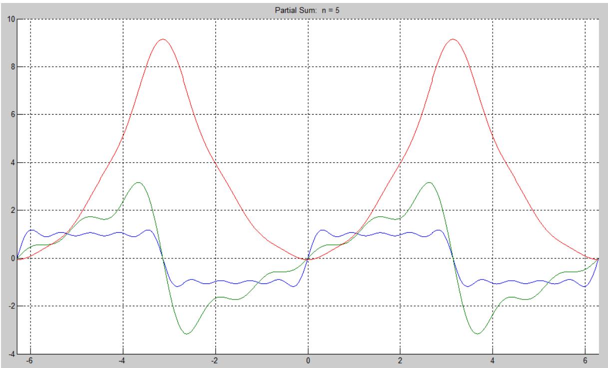
is changed to:

```
x=linspace(-2*pi,2*pi,1000);
axis([-2*pi 2*pi -4 10])
```

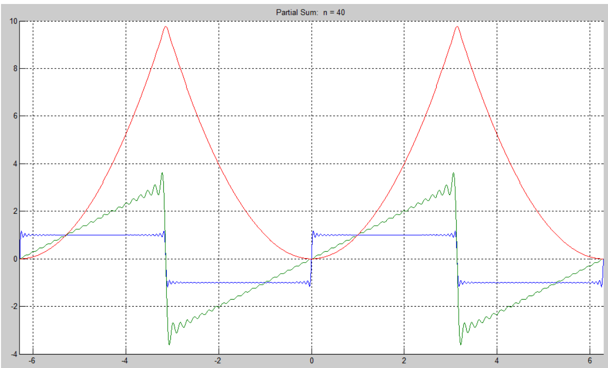
Partial sums according to this change are shown in Figure 2.



a) n=1



b) n=5



c) n=40

Figure 2. Graphical presentation of the partial sums (4) (5) (6) ((4)-red, (5)-blue and (6)-green curve) for 1,2 and 40 terms and x-axes from -2π to 2π.

In Figure 1 and Figure 2 all previous conditions of curves are deleted.

In order to obtain a precise view of partial sum and the way of curve's changing and at the same time keep previous conditions of partial sum we plot each of three partial sums in separate graphic. All previous conditions of curve are shown in different color.

Following each curve represented by different color can be observed the appearance of partial trigonometric sum for each n.

This can be done with a minor change in code by adding different color in each term.

```
colors = 'rgbmy';
```

and instead of

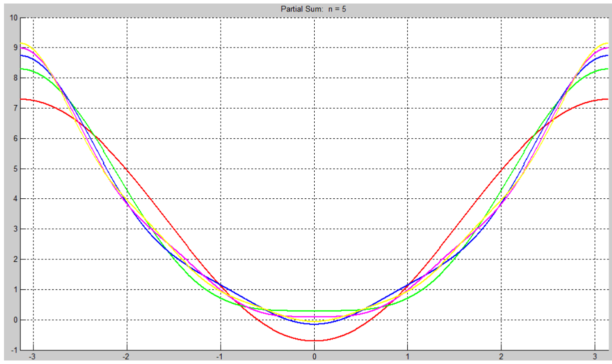
```
pause set(handle1,'Visible','off');,
```

is added:

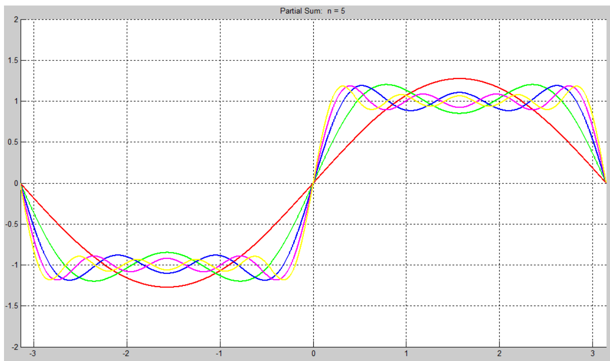
```
pause set (handle1,'Color',colors(n));,
```

where *handle1* is used for plotting partial sum and is different for different trigonometric series (4), (5) and (6) .

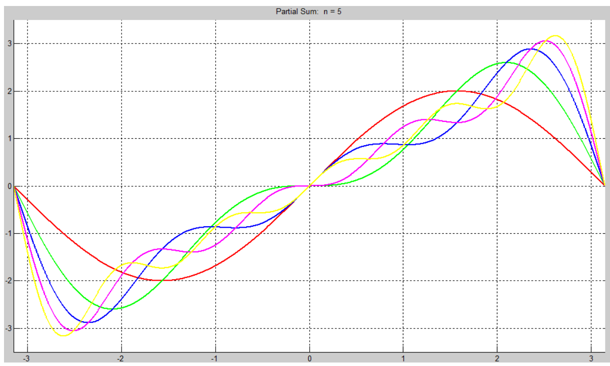
All first five partial sums of trigonometric series (4) (5) (6) are printed in Figure 3 a), b), c) accordingly.



a)



b)



c)

Figure 3. Graphical presentation of first 5 term partial sum a) of (4) b) of (5) c) of (6) red color for n=1, green for n=2, blue for n=3, violet for n=4, and yellow for n=5.

Figure 3 is useful in process of understanding of trigonometric partial sum and Fourier series.

IV. MATHEMATICAL PROOF

Using graphical representations for the given Fourier series we managed to obtain periodic functions, but their correctness will be confirmed with mathematical proof. For (6) we are going to obtain periodic function starting from given trigonometric series.

Partial sum (6) can be shown as:

$$f(x)=2\sum_{n=1}^{+\infty}(-1)^{n-1}\frac{\sin nx}{n}=-2\sum_{n=1}^{+\infty}(-1)^{n}\frac{\sin nx}{n}$$

Our aim is to show that $f(x)=x$ on the interval $[-\pi,\pi]$ is the function that is obtained by the given Fourier series.

According to De Moivre's formula, formula that is important because it connects complex numbers and trigonometry $e^{inz}=\cos nz+i\sin nz$ and according to equation

$$\log(1+z)=-\sum_{n=1}^{+\infty}\frac{(-1)^n}{n}z^n \quad \text{for } z\in C$$

we obtain:

$$-\log(1+e^{ix})=\sum_{n=1}^{+\infty}(-1)^n\frac{e^{inx}}{n}=$$

$$\sum_{n=1}^{+\infty}(-1)^n\frac{\cos nx}{n}+\sum_{n=1}^{+\infty}(-1)^n\frac{\sin nx}{n}i=$$

$$=\mathrm{Re}(-\log(1+e^{ix}))+i\,\mathrm{Im}(-\log(1+e^{ix}))$$

We start with the Fourier series to obtain the function

$$f(x)=-2\sum_{n=1}^{+\infty}(-1)^n\frac{\sin nx}{n}=$$

$$2Arg(1+e^{ix})=2\,arctg\,\frac{\sin x}{1+\cos x}=$$

$$2\,arctg\,\frac{2\sin\frac{x}{2}\cos\frac{x}{2}}{2\cos^2\frac{x}{2}}=2arctg\,\frac{\sin\frac{x}{2}}{\cos\frac{x}{2}}=$$

$$2\cdot\frac{1}{2}x=x$$

Obtaining functions from series (4) and (5) is more complex; therefore, we will use a reverse process as a proof. We will start from periodic functions we obtained to find Fourier series they represent.

First example is to find the Fourier series of the function $f(x)=x^2, x\in[-\pi,\pi]$. Because this function is even function, the coefficient b_n has zero value. Thus the coefficients of the Fourier series are

$$b_n=0,$$

$$a_0=\frac{1}{2\pi}\int_{-\pi}^{\pi}f(x)dx=\frac{2}{2\pi}\int_0^{\pi}x^2\,dx=\frac{1}{\pi}\cdot\frac{x^3}{3}\bigg|_0^{\pi}=\frac{\pi^2}{3},$$

$$a_n=\frac{2}{\pi}\int_0^{\pi}f(x)\cos nx\,dx=\frac{2}{\pi}\int_0^{\pi}x^2\cos nx\,dx=$$

$$=\frac{4}{n^2}\cos n\pi$$

For $n=2k$ is obtained $a_{2k}=\frac{4}{(2k)^2}\cos 2k\pi=\frac{4}{4k^2}$ and for $n=2k-1$ is obtained $a_{2k-1}=\frac{4}{(2k-1)^2}\cos(2k-1)\pi=-\frac{4}{(2k-1)^2}$.

Hence the Fourier series for the function $f(x)=x^2, x\in[-\pi,\pi]$ is

$$f(x)=\frac{\pi^2}{3}+4\sum_{n=1}^{+\infty}\frac{(-1)^n\cos nx}{n^2}.$$

That is equivalent to partial sum (4).

The other example is to find the Fourier series of the function $f(x)=\begin{cases}-1, -\pi\le x<0\\ 1, \quad 0\le x<\pi\end{cases}$. In this example, we have to find all the coefficients i.e. a_0, a_n and b_n where n=1,2,3…

The coefficients of the Fourier series are

$$a_0=\frac{1}{2\pi}\int_{-\pi}^{\pi}f(x)dx=0,$$

$$a_n=\frac{1}{\pi}\int_{-\pi}^{\pi}f(x)\cos nx\,dx=\frac{1}{\pi}[\int_{-\pi}^{0}-\cos nx\,dx+$$

$$+\int_0^{\pi}\cos nx\,dx]=0,$$

$$b_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin nx\,dx = \frac{1}{\pi}[\int_{-\pi}^{\pi} -\sin nx\,dx + $$

$$+ \int_{-\pi}^{\pi}\sin nx\,dx] = \frac{2}{n\pi}(1-\cos n\pi).$$

For $n = 2k$ is obtained $b_{2k} = \frac{2}{(2k)\pi}(1-\cos 2k\pi) = 0$.

and for $n = 2k-1$ is obtained

$$b_{2k-1} = \frac{2}{(2k-1)\pi}[1-\cos(2k-1)\pi] = \frac{4}{(2k-1)\pi}.$$

Hence the Fourier series for the function $f(x) = \begin{cases} -1, -\pi \le x < 0 \\ 1, \quad 0 \le x < \pi \end{cases}$ is

$$f(x) = \frac{4}{\pi}\sum_{n=1}^{+\infty}\frac{\sin(2n-1)x}{2n-1}.$$

That is equivalent to partial sum (5).

In addition, the last and already proven example with reverse process is to find the Fourier series of the function $f(x) = x, x \in [-\pi, \pi]$. Because this function is odd function, the zero coefficients in this case are $a_0 = 0$ and $a_n = 0, \forall n$. We only need to find a b_n coefficient

$$b_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin nx\,dx = \frac{1}{\pi}\int_{-\pi}^{\pi} x\,\sin nx\,dx =$$

$$= -\frac{2}{\pi}\cos n\pi.$$

For $n = 2k$ is obtained $b_{2k} = -\frac{2}{(2k)}\cos 2k\pi = -\frac{2}{2k}$

and for $n = 2k-1$ is obtained

$$b_{2k-1} = -\frac{2}{(2k-1)}\cos(2k-1)\pi = \frac{2}{(2k-1)}.$$

Hence the Fourier series for the function $f(x) = x, x \in [-\pi, \pi]$ is

$$f(x) = 2\sum_{n=1}^{+\infty}(-1)^{n-1}\frac{\sin nx}{n}.$$

This partial sum is equivalent to partial sum (6).

These three proves confirms graphically obtained functions.

V. CONCLUSION

Fourier series are infinite series that represent periodic functions in terms of cosines and sines. Because these series can be used in solving different problem in many scientific fields, very important is process of their understanding. We gave a brief introduction to Fourier series and tried to facilitate their understanding with graphical presentation using Matlab. In addition, with these graphical representations we tried to facilitate the way of obtaining periodic functions knowing the Fourier series. This process, using only mathematical equations can be complex and difficult to accomplish. Therefore, we tried to easier this process by obtaining functions using Matlab and plotting partial sums. From graphical representation of trigonometric series, we noticed that with the large number of terms included in this series, approximation to the periodic function could be very close. We also gave and mathematical proof that obtained functions from our graphical representation of Fourier series is correct periodic functions.

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USE OF MULTIMEDIA TO TEACH GRAMMAR SCHOOL CELL BIOLOGY

V. Odadžić[*], B. Odadžić[**], T. Miljanović[***]
[*]Zrenjanin Grammar School, Zrenjanin, Republic of Serbia
[**]University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
[***]University of Novi Sad ,Department of Biology and Ecology, Faculty of Sciences, Novi Sad, Republic of Serbia
vesna.odadzic@gmail.com, borislav.odadzic@gmail.com, tomka.miljanovic@dbe.uns.ac.rs

Abstract - The paper analyzed comparative effectiveness of multimedia and traditional teaching method in biology on grammar school pupils. This experimental study was conducted in a grammar school in Zrenjanin, Serbia. A stratified random sample consisted of 60 students 1st grade of grammar school, wich were randomly distributed into control and experimental groups. The students in the experimental group learned the subtopic Cell division by multimedia software, whereas the students in the control group learned the same content by the traditional teaching. The research design was the pre test - post test - post memory retention test, equivalent groups design. All students received one pre-test in order to estimate their prior knowledge, post test in order to assess knowledge and comprehension immediately after learning and post memory retention test again after 21 days. Analysis of the results of the post test and the post memory retention test showed that students from the experimental group achieved significantly higher quantity and quality of knowledge than students from the control group.

I. INTRODUCTION

Information and communication technologies (ICT) in human society is one of the most important characteristics of today's world. Technology integration in the classroom could potentially affect at students in positive ways. Hansel and Hill [1] found out that pupils using computers had more positive attitude towards biology and natural sciences than pupils who were educated by traditional styles.

The use of ICT in classrooms may change a behavior of students. Using the new technologies students demonstrate a greater spontaneous interest in a learning activity; the time and attention devoted to learning activities increases. In technology-aided education, visual materials such as animations, animated pictures and multimedia software have a great importance. [2]; [3]; [4].

II. MULTIMEDIA IN TEACHING AND LEARNING PROCESS

A. *Concept of multimedia*

Multimedia is a combination of different elements text, graphics, animations, simulations and sound. [5], a multimedia instructional message is a presentation consisting of words and pictures that is designed to foster meaningful learning. The theoretical foundation for the cognitive theory of multimedia learning draws from several cognitive theories including Adele's model of working memory [6], Pavia's dual coding theory [7], and Seller's theory of cognitive load [8]. The cognitive theory of multimedia learning centers on the idea that learners attempt to build meaningful connections between words and pictures and that they learn more deeply than they could have with words or pictures alone [5]. According to cognitive theory of multimedia one of the principle aims of multimedia instruction is to encourage the learner to build a coherent mental representation from the presented material. Although interactive multimedia capabilities are constantly evolving and became very popular among educators in recent years.

B. *Literature review*

Previous research indicates that using multimedia in biology curricula improved student achievement. Rift and Stewart [9] in their study indicated that the multimedia software used greatly enhanced students understanding of the subject matter. Siegel and Foster [10] in their study demonstrated that students learned more in a high school anatomy and physiology class when they were exposed to multimedia software, and created projects with presentation software. Task & Soran [11] examined the effects of multimedia applications on learning at the level of comprehension and implementation in cell division unit and discovered that the experimental group taught with multimedia applications achieved more compared to the group taught with traditional methods. Multimedia teaching is more superior to conventional method in significantly promoting achievement in biology [12]. Use of multimedia with animations has a significant effect in biology teaching because that allows students to learn effectively [13]. Multimedia is more realistic for showing change; they can demonstrate in action the systems to be taught and can show change in time. [14].

III. Research Methodology

The purpose of this study was to determine the effects of multimedia applications on learning achievement and comprehension levels and memory retention compared with traditional techniques of teaching subtopic Cell division.

This paper reports on a multimedia activity aimed to enhance students' understanding of fundamental concepts and processes in the Grammar school Biology curriculum. Cell biology is one of the cornerstones of modern biology. Cell Division is one of the most problematic and difficult concepts that students need to learn [15]; [16]. Questions on Cell Cycle, Mitosis and Meiosis concepts in Cell Division are very difficult for learners to conceptualize using traditional teaching methods. Thus, there is a need to expose teachers to various strategies which will result in better teaching learning process. For success, teachers have to be provided with a material which is different and more effective than what is traditionally presented in text books [12].

The following research hypotheses were tested in the research:
H1: Pupils in Group E will achieve better results on the post test in each level of kowledge (knowing of the facts, applying of knowledge and reasoning) than pupils in Group C.
H2: Pupils in Group E will achieve better results on the post test in general than pupils in Group C.
H3: Pupils in Group E will achieve better results on the post memory retention test on each level of knowledge than pupils in Group C.
H4: Pupils in Group E will achieve better results on the post memory retention test in general than pupils in Group C.

The research was true experimental in nature because the equivalence of the control group and the experimental group was provided by random assignment of pupils either to the experimental or the control group. In the pedagogical research, two classes with the total of 60 pupils of the first form in Zrenjanin Grammar School took part. The experimental (E) group consisted of three classes with 30 pupils, and the control (C) group had three classes with 30 pupils. The experimental group was taught Cell Division topic using multimedia education software with animations while the control group was taught the same subtopic through a traditional way (verbal–textual and demonstrative–illustrational teaching methods and frontal form of work), for three weeks. Teaching subtopic consisted of four main concepts on Cell Division: Cell Cycle, Mitosis, Meiosis I and Meiosis II.

At the beginning of the research, before the introduction of the experimental factor in the E – group both groups were made equal on their success on the pre test of knowledge in Biology.

After making the groups equal the pedagogical experiment was done. The post achievement test was given immediately to both experimental and control group after they finish learning the topic. Post memory retention test was given three weeks later after the post achievement test.

By using suitable instrument of research (knowledge tests) data are acquired through which generalizations and conclusions were possible giving recommendations and explanations important for the pedagogical practice.

Tests of knowledge (pre test, posttest, post memory retention test) are formed as a set of tasks of objective type. All three tests were done based on 100 points and comprised three subtests: Level I - level of knowing facts, Level II - level of understanding notions and Level III - level of analysis and reasoning. The time allowed for test completion was the duration of one lesson (45 minutes). The values of Cronbach's Alpha for the pretest (α=0.81), the posttest (α=0.92) and the post memory retention test (α=0.89) have indicated a high internal consistency of tests.

In order to compare the differences between the C and E groups on the pre test, post test and post memory retention test results, the independent t-test was applied. Statistical data processing obtained from these tests was done by using SPSS 19.0 software package.

IV. Results and Discusion

A. The results of the Pre Test

Basic statistical parameters: number of pupils in E and C group (N), arithmetic mean (M), standard deviation (SD), standard error (SE) of t-test and border of importance (p) at pre test of knowledge (at levels and test as a whole) for experimental and control groups are presented in the Table 1.

TABLE 1. SIGNIFICANCE IN THE DIFFERENCE OF RESULTS OF PUPILS' E AND C GROUPS AT PRE TEST AT LEVELS AND TEST AS A WHOLE.

Levels of knowledge	Group	N	M	SD	SE	t test	Sig. (2-tailed)
Knowing the facts	E	30	17.126	2,039	.218	.978	.329
	C	30	17.418	1.887	.204		
Understanding	E	30	43.885	4.499	.482	.765	.446
	C	30	44.407	4.478	.483		
Analysis and reasoning	E	30	18.046	3.110	.333	.528	.598
	C	30	18.291	2.989	.322		
Total achievement on the test	E	30	79.057	8.163	.875	.850	.397
	C	30	80.116	8.228	.887		

According to the results of the pupils in E and C group at pre test (Table 1), as well as the values at t-test, there is no statistically significant difference in pupils' achievement in E and C group at pre test at individual levels of knowledge (I level: t = 0.978; II level: t = 0.765; III level: t = 0.528) and at the test in general (t = 0.850). According to statistical parameters of pre test the knowledge of pupils in E and C groups in Biology are at the beginning of the research well - equalized. That fact made further research possible and also the analysis of its results.

B. The Results of the Post Test

The post test test was done in all classes of E and C groups immediately after the realization of the pedagogical research. The results of the final test are presented in the Table 2. The difference in the score beneficial for experimental group, demonstrates that more thorough knowledge was achieved by using the multimedia while implementing the contents in Cell division, compared with a traditional way of studying. According to the results of t-test for E and C groups, there are statistically important differences in pupils' achievements in E and C groups at the final test which are beneficial for experimental groups at certain levels of knowledge (I level t = 6 545; II level t = 10 830; II level t = 11 348) and at the test in general (t = 11 520). The differences are especially important at tasks of II level and III level of knowledge. Thus confirming the hypothesis H1: Pupils in Group E will achieve better results on the posttest in each level of kowledge (knowing of the facts, applying of knowledge and reasoning) than pupils in Group C; and hypothesis H2: Pupils in Group E will achieve better results on the post test in general than pupils in Group C.

TABLE 2. THE SIGNIFICANCE OF THE DIFFERENCES OF PUPILS' RESULTS IN GROUPS E AND C AT THE POST TEST ACCORDING TO LEVELS OF KNOWLEDGE AND AT THE TEST AS A WHOLE.

Levels of knowledge	Group	N	M	SD	SE	t test	Sig. (2-tailed)
Knowing the facts	E	30	18.873	1.421	.152	6.545	.000
	C	30	17.163	1.976	.213		
Understanding	E	30	51.138	3.159	.339	10.830	.000
	C	30	44.372	4.885	.527		
Analysis and reasoning	E	30	19.850	2.335	.250	11.348	.000
	C	30	15.733	2.437	.263		
Total achievement on the test	E	30	89.862	6.178	.662	11.520	.000
	C	30	77.267	8.085	.872		

Much better results of the pupils in E group is scored while solving more difficult tasks and questions (II and III cognitive level) at the post test, comparing it with the pre test, in other words higher competence in solving complex tasks was notices which is exceptionally significant. The results of the research show that the realized difference in pupils' achievements E and C groups at the post test in not only the difference in the quantity but also in the quality of their knowledge in Biology. The outcome of the differences in pupils' achievements is the result of adequately chosen teaching contents and their efficient realization by the use of multimedia and individual form of work in experimental group, in comparison with the traditional approach of teaching process of the same subtopic in the control group of students.

C. The Results of the Post Memory Retention Test

The pupils of the E and C group did the post memory retention test 3 weeks after the post test. The post memory retention test was identical with the post test and it was done to determine the duration and quality of the acquired knowledge of the pupils in both groups. The results of the post memory retention test at certain levels of knowledge (I, II and III) and at the test in general, as well as results of the t-test for both groups are presented in Table 3.

According to the results of t-test for E and C groups there are important statistical differences between E and C groups at the post memory retention test that are beneficial for the experimental group in each of the three levels of knowledge (I level t = 7 178; II level t = 10 655; III level t= 11 190) as well as at the test in general (t = 11 551). The results of the test shows the better retention of knowledge among the pupils of E group. Thus confirming the hypothesis H3: Pupils in Group E will achieve better results on the post memory retention test in each level of kowledge than pupils in Group C; and hypothesis H4: Pupils in Group E will achieve better results on the post memory retention test in general than pupils in Group C.

By comparing the results of E group pupils' success in specific level of knowledge at the post test and post memory retention test in comparison with the pre test, their significant progress is noticed, especially at tasks in II and III level of knowledge and a bit smaller success in solving the tasks from level I. The total achievement of E group pupils at both tests (post test and post memory retention test) is much better than the one at the pre test. Such better results of the E group pupils at the post test and post memory retention test are due to the work at the teaching subtopic Cell division in the group with the application of multimedia and individual form of studying.

According to the E group pupils' achievement at the post test and post memory retention test aplication of multimedia and individual form of work occupies pupils more in studying and enables their self-reliance and creativity to be shown. Besides, the E group pupils studied by using a high quality multimedia software in which the teaching material was much better presented and illustrated than in the current textbook in Biology.

The achievement of the C group pupils at the post test and post memory retention test in individual levels of knowledge and at tests in general did not show significant changes, compared with their achievements in at the pre test of knowledge. A slight fall in pupils' achievements is noticed in this group at each test that follows, which shows that contents of the subtopic Cell division are more comprising and complex. Much weaker results of the C group of pupils were shown at the post test and post memory retention test in comparison with the success of pupils in E group, which can be explained by the way of the contents realization on the subtopic Cell Division in the C group in the traditional way of teaching. The efficiency of these kinds of lectures and enhanced motivation of students is especially emphasized. Multimedia software can be used to explain the concepts and processes in such a manner that is not possible through traditional practices. Achieved results show students' interest for these types of lectures and learning, and output results show that the students' average grades are higher in comparison to traditional approach of learning with lecturing subtopic Cell division.

This result is consistent with prior studies which have stated that application of multimedia in biology could improve pupils achievement [17]; [18]; [19].

TABLE 3. THE SIGNIFICANCE OF THE DIFFERENCES IN THE RESULTS OF THE PUPILS IN E AND C GROUPS AT THE POST MEMORY RETENTION TEST AT LEVELS AND THE TEST AS A WHOLE.

Levels of knowledge	Group	N	M	SD	SE	t test	Sig. (2-tailed)
Knowing the facts	E	30	18.782	1.536	.165	7.191	.000
	C	30	16.767	2.107	.227		
Understanding	E	30	50.931	3.072	.329	10.655	.000
	C	30	44.105	5.115	.552		
Analysis and reasoning	E	30	19.770	2.229	.239	11.190	.000
	C	30	15.698	2.549	.275		
Total achievement on the test	E	30	89.459	5.957	.639	11.551	.000
	C	30	76.569	8.511	.918		

V. CONCLUSION

In the curent study, a multimedia software related to the subtopic Cell division has been developed and applied to the pupils from the first form of Grammar School. Due to the rapid advancement of computer technology and pupils' positive attitudes towards computer technologies, many instructional multimedia tools, related to the subtopic which are difficult to be understood by pupils.

According to the analysis of the pedagogical research results, realization of the teaching contents by the innovative approach offers the opportunity to improve the teaching and learning of Biology in the Grammar School. The differences in achievement of the students from experimental and control groups on post test and post memory retention test are statistically significant in favour of the experimental group. The results of this research indicated that multimedia had contributed significantly to the better quality of the pupils' knowledge than had the traditional way of learning. The main hypothesis of the research was thus confirmed. The results of this study suggest that the use of multimedia can be beneficial in the implementation of Biology education curriculum, particularly in teaching concepts and principles of Cell Biology. Multimedia materials can also be developed and implemented for different topics at different grade levels.

The major findings of the study is that multimedia teaching significantly promoted achievement with respect to knowledge, understanding notions and analysis and reasoning and total achievement in biology in comparison to traditional method. The major conclusions drawn from the findings from the study is that application of multimedia in teaching and learning Biology in Grammar School is more superior than traditional method and significantly promoting achievement in Biology.

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MODEL OF CROWDSORCE ENVIROMENTAL APPLICATION BASED ON MOBILE PHOTOS

A. Stojanova*, M. Kocaleva*, V. Manevski**, I. Kocev*, B. Delipetrev*
*Faculty of computer science, “Goce Delcev” University, Stip, Macedonia
**Faculty of Natural and Technical Sciences “Goce Delcev” University, Stip, Macedonia
(aleksandra.stojanova, mirjana.kocaleva, blagoj.delipetrev)@ugd.edu.mk, manevski81b@gmail.com
ico.kocev@gmail.com

Abstract - Smartphones have become easy affordable and powerful tool for sharing information among people. Using applications, cameras, internet connectivity, and GPS location ability, smartphones can be used for gathering information from different sources. Sources can even be ordinary people from different places, but obtained knowledge can be helpful even to scientists in process of finding most appropriate solution of some particular problems, where data from different places is crucial. In this paper, we present our model of interactive, fun and easy to use application that uses geo tag photos taken from mobiles to identify the changes of environment and to increase the environmental awareness among people. We also give a brief review of existing applications that have something in common with our proposed model.

I. INTRODUCTION

Smartphones have revolutionized the Information and communications technology (ICT). In a matter of a decade of their existence, the smartphones have integrated many devices including camera, GPS receiver, watch, and the computer. Most of the smartphones today possess vast computational power providing opportunities to support powerful mobile application. Soon as we approach inevitable IoT (Internet of Things) revolution, smartphones can provide a platform for connecting smart devices and sensors (IoT) that will be deployed everywhere.

Mobile app have unique features that can engage public in issues that affect them, making Citizen Science which is a form of research collaboration involving the public in scientific research projects to address real-world problems. Often the information that citizens produce has a GPS tag producing volunteered geographic information (VGI). Crowdsourced VGI is spatial information that is generated and donated by citizens, usually using spatially enabled mobile devices [1][2]. Smartphone mobile applications are ideal and most usable tool for developing citizen science and VGI [3] [4].

Crowdsourced VGI mobile app can educate and engage the public in conservation issues. Recordings made using mobile apps with GPS devices can be made and used to plot the location, count, and spread and of pollution, animal and plant biodiversity, diseases, natural and made disasters. This data made by citizens in the field can be used in searchable databases and map visualizations of these phenomena. This kind of spatial information donated voluntarily by citizens can be used as a low cost labor way to find solution of some global problems in different fields of science. Our aim is to create an app that is easy to use by ordinary people so it can be easily acceptable by them. Taking photos by mobile phones is the easiest and most widely used way to perceive memories. Therefore, we decided to use mobile photos as a crowd sourced information to monitor the change of the environment, because one picture is worth a thousand words.

All people are part of the planet and all of them are responsible for the changes that affect the nature and environment. Having that in mind, our model of application is quite simple. When a person or a user identifies something that is worth acknowledging (wheatear is a positive or negative) simply takes a picture from his smartphone and uploads it. Photos connected with their geo location are stored in a database, so any other user can see the photo can like or dislike it, leave a comment or can go and visit that place from the picture.

This paper reviews other existing mobile android applications, which have similar elements with our model. We present a brief review of their characteristics and way of their working. Then, we explain our proposed model and explain its main characteristics, features and technologies needed.

II. Review of Existing Applications

There are other existing mobile android applications, which have similar elements with our model. We will review some of them like: C: geo, PhotoMap, PhotoTracker, Geology Sample Collector, Aumentaty Geo, Jeco Guides, My Augmented reality, Blue green map of Serbia, What is around?, GPS Photo Viewer with GoogleMap and GPS Photo Viewer with Here map.

C: geo [5] is open source, full-featured client for geocaching.com that supports other geocaching platforms (like Opencaching). This application uses Google Maps or OpenStreetMaps and user can view caches on a Live Map. The users can search for caches by various criteria, can navigate using maps or compass and can store cache information on his device for later offline access. User on every location can easily see and find all nearby places on the map. This app has more than 1.000.000 users and the c:geo interface is shown in Figure 1.

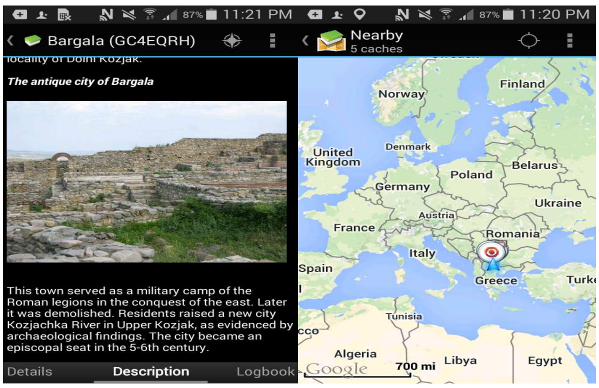

Figure 1. Screenshots from the interface of C: geo app

PhotoMap [6] has 100.000-500.000 downloads. The purpose of this app is to relieve a user's vacation by virtually travelling from one location to another. In this app, photos taken from the camera, when camera's GPS is enabled, are automatically added to the locations on the map. There is also a chance to take a photo in the app itself, because it has integrated camera starter. Photos from one user are not available to others, but there is an option to share these photos on the social networks. This app interface is shown in Figure 2.

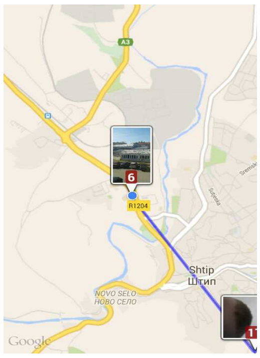

Figure 2. Screenshot from the interface of PhotoMap app

My GPS photomaps [7] are very similar to Photomap and uses photos taken from camera with GPS tag. This app only shows the user's photos with their GPS position on Google maps. This application is personal to the user and user cannot see pictures from other users but only photos taken from his camera. This application can be used to re-live user's travels. When more pictures are taken from the same place, they are grouped together on the same mark. This application has 5.000-10.000 installs.

PhotoTracker [8] is an app suitable for people interested in travelling and photography. This application shows users' photos on a map with their geo-tag and presents photos from photo-sites such as Flickr and Panaramio. Photo Tracker is not only a photo-viewer, but also allows geo-tagging photos taken from an ordinary camera without a GPS navigator. It is also gives locations of many interesting places on the map taken from Wikimapia. User using this app can explore the most photographed places in the world, also places in his neighborhood and can filter displayed photos. This app has 10.000-50.000 users. This app interface is shown in Figure 3.

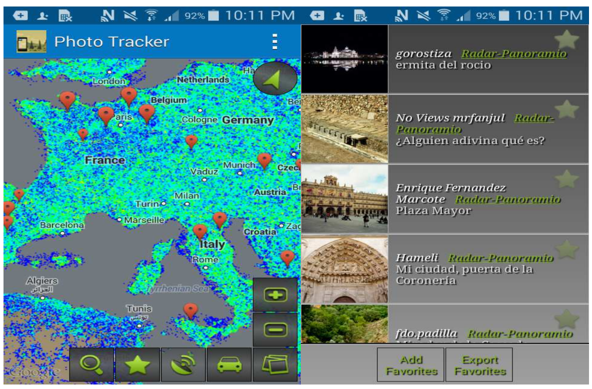

Figure 3. Screenshots from the interface of PhotoTracker app.

The Geology Sample Collector [9] is an app specially designed for geologists that allows the user to track and save his collected images, video or audio recordings. For all collected media this application saves time and place of taking, using GPS, and the user is allowed to write some other details too. This app is synchronized to a website where user can edit and/or share his work with others through social networks, e-mail, etc. Once the collecting is uploaded to the website, the user can edit the data, create reports and/or maps, and download the data or reports to spreadsheets or other documents. Once the collecting is completed, the user can automatically create a power point or video of the sampling. Other users of the app can view only shared collections and not all collections and uploaded media from this application. Geology Sample Collector has 10.000-50.000 installs. In Figure 4 are given screenshots from this application's interface.

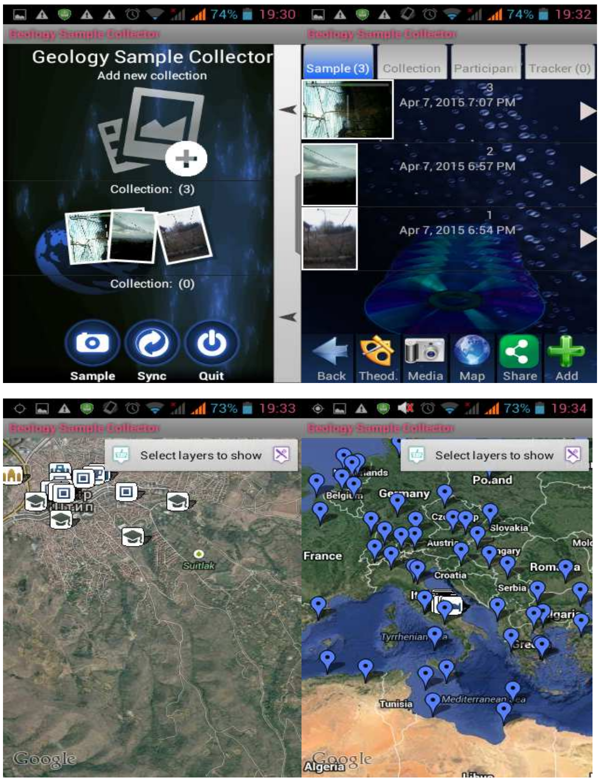

Figure 4. Screenshots from the interface of Geology Sample Collector app

Aumentaty Geo [10] is app that points most popular created routes and helps users discover new places. Geo Aumentaty combines augmented reality and geo-locations and is used to show real-time information of the points of interest created by users. The geographic augmented reality uses the physical coordinates and compass of the user's device to display overlays virtual items and place them in real positions. Users can also comment, upload contents, linking points of interest and create their own routes. Geo Aumentaty consists of two parts, a content management system and mobile application. The mobile application allows users to find the routes that have been created by other users, get the points of interest of each route, show the associated information, locate it on a map and provide direction. In addition, users can rate every route and every point of interest. Aumentaty Geo allows users looking through the camera of their mobile devices to explore the environment around them are searching for selected locations. This application has near 1.000 users. The features of mobile Aumentaty Geo mobile application and content management system are shown in Figures 5 and 6.

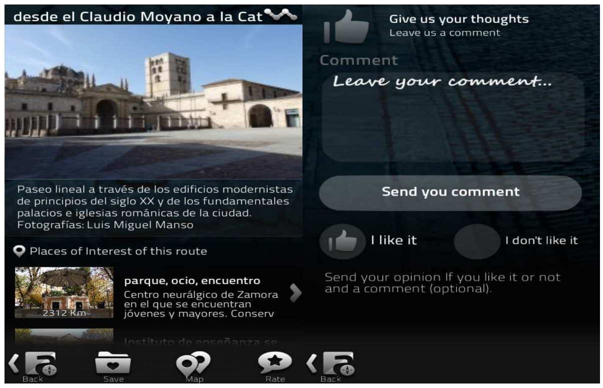

Figure 5. Features of Aumentaty Geo mobile application

In Figure 6 is given screenshot from Aumentaty Geo content management system.

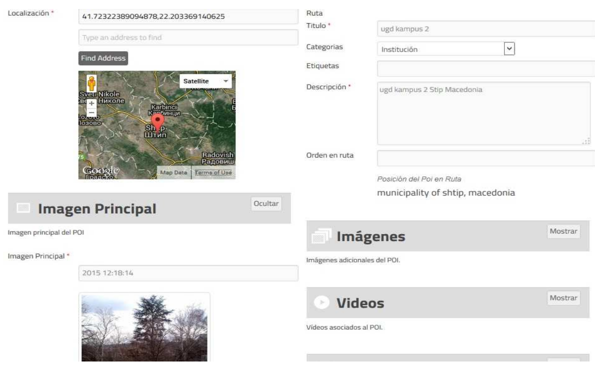

Figure 6. Screenshot from Aumentaty Geo content management system.

Jeco Guides [11] app is actually a kind of library of interactive and multimedia guides. Local authors can edit this guide. Jeco Guides allow the user to discover and explore interesting places around him. There is List, Map and Augmented Reality view. Local authors can edit guides through the Authoring Tool on www.jecoguides.com. Augmented reality gives information about near places on user's camera display. There is also the possibility to download the guides and they can be accessed without internet access. This app can locate the user's position and show nearby places saved with the map. This app is easy to use and drive the user in an interactive and multimedia experience. There is also cloud app where users can saves guides and free up mobile memory. This mobile app has nearly 5.000 downloads. The mobile app is shown in Figure 7 and the cloud app in Figure 8.

Figure 7. Screenshots from Jeco Guides mobile application's interface

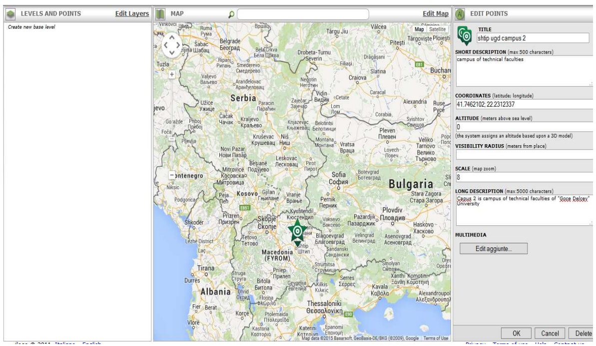

Figure 8. Screenshot from Jeco Guides cloud application's interface

My Augmented reality [12] app is used to store locations that user has been to, or intends to go and wants to find those places later. The user takes pictures from places he stores and then can use Map view or Augmented Reality (via the phone's camera) to find his saved places. It uses Google maps and only saved locations are pinned on the map. This app has more than 10.000 users. Some screenshots of this app are given in Figure 9.

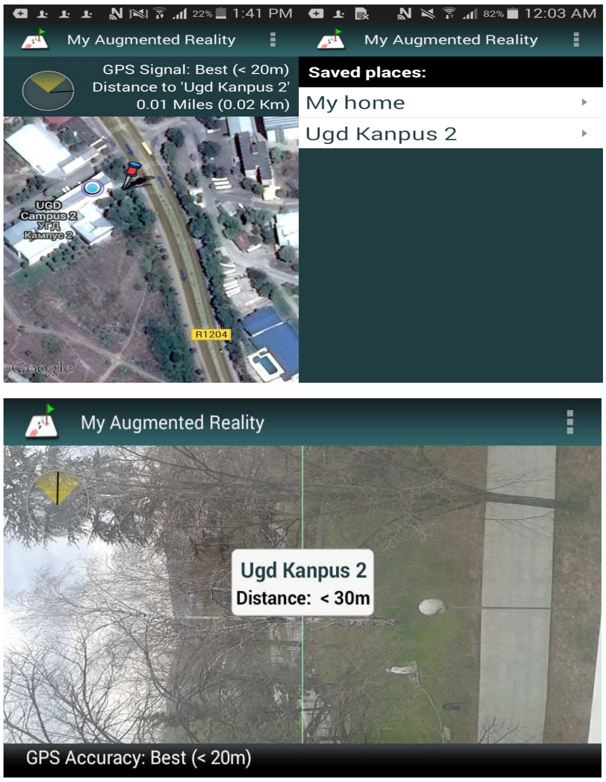

Figure 9. Screenshots from My Augmented reality app.

Blue green map of Serbia [13] is specially named for travelers to Serbia. User can discover all interesting places and can get relevant information. Also in this app, there is a possibility to use augmented reality to find locations of user's interest. There is no chance for user to import photos. This application has just 50 users.

What is around? [14] is an app that combines geo tagging with augmented reality and allows users to explore and discover places around their current location and other places on the map. User can search and explore chosen area by choosing source like: Yellow Pages, Open Table bars and restaurants, Flickr, Instagram and Panoramio pictures, Twitter, Last.fm events, Foursquare and Wikipedia places, YouTube videos. There is no option for user to take pictures and upload any kind of media, but he can search for already upload media thought mentioned sources. If a user is searching places around his current location than he/she can use augmented reality option to find places from where some content is uploaded and shared. This application has around 500 installs. Some screenshots from the application are given in Figure 10.

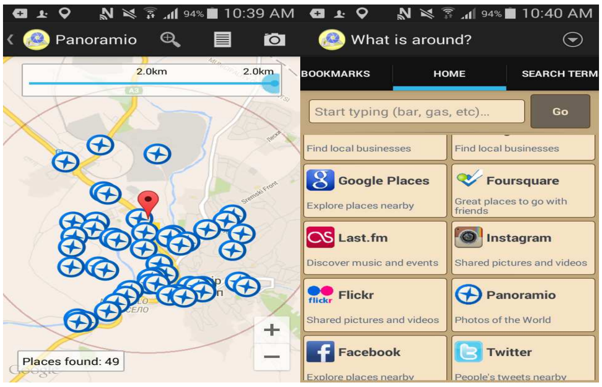

Figure 10. Screenshots from What is around? Application

GPS Photo Viewer with GoogleMap and GPS Photo Viewer with Here map [15] [16]. These applications are working on the same way but they are using different maps. The first one uses GoogleMap and the second here map. They work better when camera's GPS is enabled and can make difference between photos, which have GPS info, and those, which do not. Applications connect the photos with their location and show them on GoogleMap or Here map.

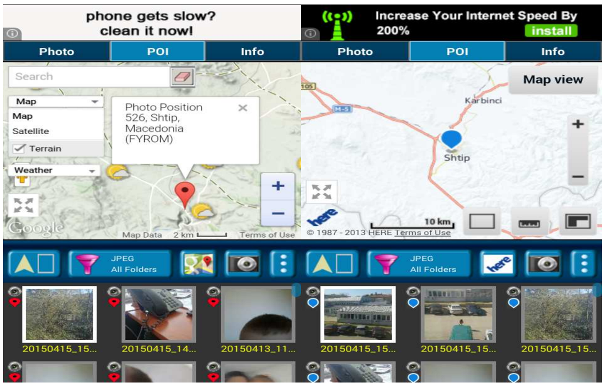

Figure 11. Screenshots from GPS Photo Viewer with GoogleMap and GPS Photo Viewer with Here map

The aim of these applications is users to share photos with friends and if they like the place then they can go there. Both apps are from same developer and the application that uses Googlemaps has 10.000-50.000 installations and the other one has 1.000 to 5.000 installations. Not all photos placed on the maps can be viewed from all users of the applications; users just can share their photos and locations on social networks or e-mail. There is not user account for using these applications. Screenshots of this app are given in Figure 11.

III. MODEL APPLICATION

Our aim is to build application, which is easy to use, user friendly, and use multiple technologies and platforms that are already proven and recognized by users. Pictures taken and uploaded from ordinary people will contribute to increase citizen science and awareness of the changing environment. Not only ordinary people but also the scientific community will have an immense benefit from this application. The model is consisted of a mobile and cloud application.

A. Mobile Application

Mobile app is planned to have Android and afterwards an iOS version. With the start of the mobile app, it will activate the mobile phone GPS. The users can take a photo (Instagram style) and add it to his profile. The starting interface will present a map with locations gained from the database with a determined radius from the smartphone position, shown on the left in Figure 12. When clicking on a location it will show number of likes/dislikes (Facebook style) and additional button "info" that will contain comments (Twitter style), GEOSS maps and essay.

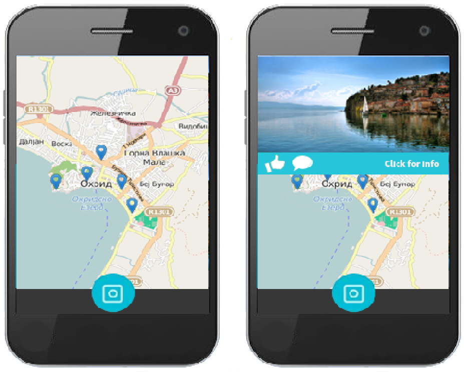

Figure 12. Prototype design of the our mobile interface

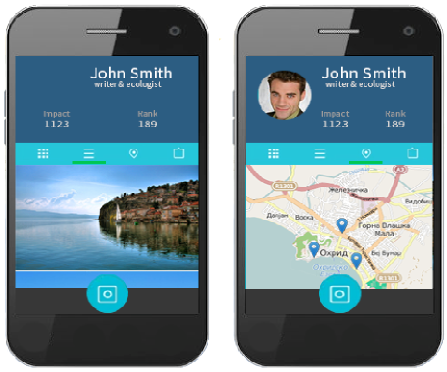

Figure 13. Prototype design of the photo mode mobile interface

The user profile will contain information about a specific user, pictures, comments and others. The prototype user profile interfaces are shown in Figure 13.

From the mobile app, the user can preview other users' photos and put additional like/dislike or comment on the photo only if he is on the same position where the photo was taken (in a predefined radius). This option will prevent users commenting or like/dislike photos that they have not seen in reality.

B. *Cloud Application*

The users can register on the cloud application as shown in Figure 14. The registration page is the same for registered or new users and contains two forms (sign in and sign up). Each user will have its own username and password, and from the cloud application, he/she will be able to view his own photos. Users will be able to see its history, visited places, photos, comments etc.

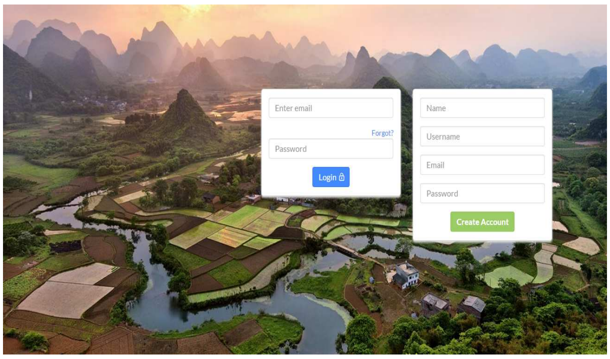

Figure 14. Cloud application registration page

The cloud application interface is composed from Openstreetmap, menu bar and search bar. Our cloud application presents the map of Europe containing multiple locations sorted by the popularity of the event/photo (likes, dislikes, tweets). Each different zoom (layer) collects new multiple most popular events for the desired scope. We plan in the further development of the application to have several filters to select different points on the map depending on their properties (attributes), similar to Booking.com when a hotel is selected based on price, location, reviewers etc. When one event is pressed a pop up is open that presents the essential information about the location, shown in Figure 15.

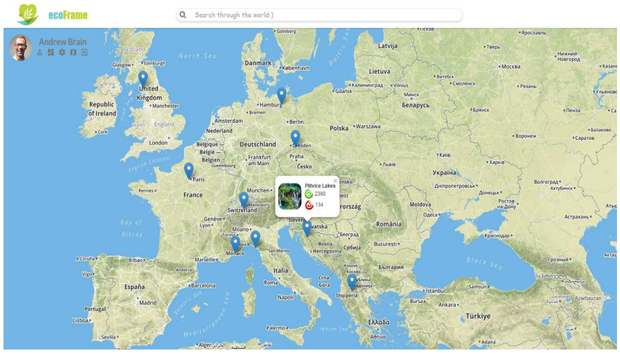

Figure 15. Cloud part application interface

The users can select from a defined GEOSS maps that are categorized in several themes: Agriculture, Biodiversity, Climate, Disasters, Ecosystems, Energy, Health, Water and Weather. The Figure 16 contains the layer of forest maps in Europe as a background. For example, the user can make a photo of a forest and connect it to the background forest map of Europe from GEOSS [22], presented in the Figure 16.

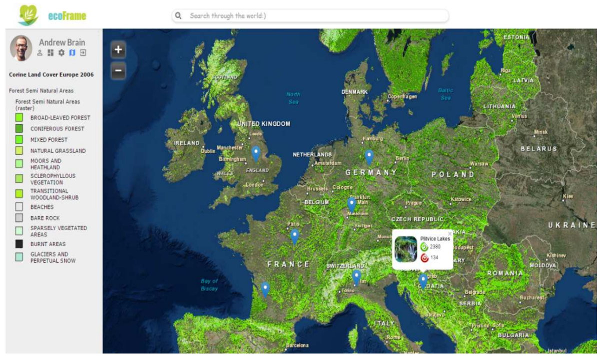

Figure 16. GEOSS integration with the forest map of Europe in our model of application

C. *Architecture and technologies*

The application workflow, shown in Figure 17, begins with starting the application on the smart phone. The smartphone gets the position from the GPS coordinates, which are sent to the server that returns the "hotspots" nearby locations. The mobile app asynchronously connected with the cloud app. The cloud application can be accessed from a web browser and has the functionalities described before.

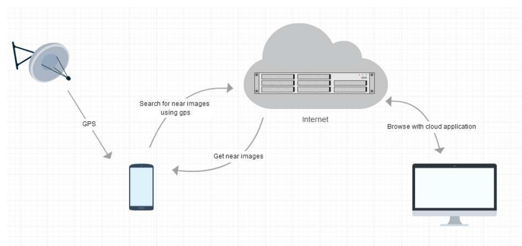

Figure 17. Application workflow

The application will be able to store temporary data about near location's hotspots in SQLite database. In addition, we plan to use OpenCV, as a technology for image processing. After the photo is taken, it will be automatically uploaded to the server. The mobile technologies used are shown in Figure 18.

Figure 18. Technology required for developing mobile application

The cloud application technology and software will be based on Amazon Web Services (AWS), Google Cloud Platform and Xen cloud server. The Geomatic laboratory at the University Goce Delcev has its own test server based on the Xen cloud platform that can support this application. We have experience in developing specialized cloud/web GIS application based on open source software similar to this application [17] [18] [19] [20].

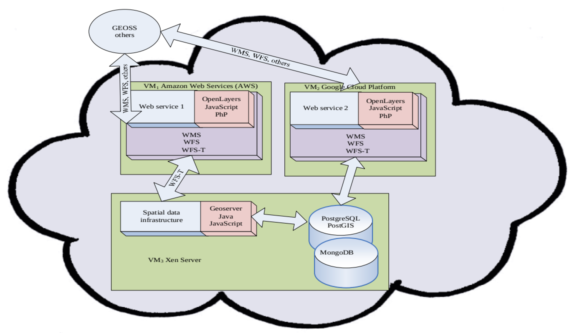

Figure 19. Preliminary our model's cloud application architecture

The front end of the cloud application will be coded in JavaScript, Node.js, Ajax and PHP. The OpenLayers library will be used to support geospatial web operations based on OGC - Open Geospatial Consortium standards (WMS, WFS, WFS-T). Geoserver is planned as a middle tier and the database can be built on PostgreSQL and PostGIS. MongoDB will be used as a database for improved scalability. All of the previous mentioned software components are open sources, interoperable and scalable. The preliminary architecture of our cloud application is shown in Figure 19. The proposed architectures and software are interoperable and portable to any platform. The MonboDB is successfully used as noSQL solution in geospatial application [21].

IV. CONCLUSION

This paper describes a model of the prototype crowdsourcing mobile and web/cloud application, and its main concepts, key features and benefits, and preliminary architecture and technologies. Also, is given a review from all existing similar applications.

Our model combining several concepts that are already proven including likes/dislikes (Facebook), comments (Twitter), pictures (Instagram) with some new feature. All these concepts are integrated together with the GEOSS maps and open data sources.

Another important advantage of the proposed model application is that is based on open sources software and technologies. The cloud application software and technologies are PostgreSQL, PostGIS and MongoDB for a database tier, GeoServer as a middle tier and geospatial data management, and OpenLayer library that supports the (OGC) standards (WMS, WFS, WPS, etc.) and custom code in PHP, JavaScript and AJAX. This architecture is scalable, interoperable and deployable on different platforms. This paper presents the main idea, design and a preliminary plan for the application development.

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APPLICATION OF CISCO PACKET TRACER 6.2 IN TEACHING ADVANCED COMPUTER NETWORKS

D. Čabarkapa
Higher Technological School of Professional Studies, Šabac, Republic of Serbia
d.cabarkapa@gmail.com

Abstract - Cisco Packet Tracer 6.2 is simulation-based learning environment software that allows students to experiment with computer networks behaviors and helps develop their skills such as decision making, critical thinking and problem solving. This software provides a visual simulation of complex networking concepts and configurations and allows students to practice using a command-line interface. These simulation capabilities can help simplify the learning process and other visual representations of internal networking functions, such as real-time dynamic data transfers and packet content expansion. The purpose of this paper is to present and investigate the possibilities and key features of the Packet Tracer 6.2 software, important for teaching and development of modern computer networks.

I. INTRODUCTION

One thing we surely can agree on is that the Internet will indeed grow exponentially over the coming years. The deployment of applications with increase in demand for bandwidth and the development of new services, have all caused an immense advance of computer networks technology. Differentiation between the classic structures of local (LAN) and wide area networks (WAN) has become less distinct. Due to the current rate of technology innovations, a computer networks could become obsolete within two to three years. Hardware upgrades of active network devices and components to the next level of technical development can usually be implemented with more or less effort.

There is high demand for computer networking skills in industry, education, military, commerce, wireless/wired communication technologies etc. Consequently, computer networking courses are becoming very popular in universities, higher technical schools and private training institutions across the globe [1]. However, it is often difficult to motivate students to learn basic computer network principles and technologies, because students find the topics rather abstract when they are presented using a traditional lecture format. One of the main imperfections about network devices is that students often cannot view or access the real network equipment and cannot analyze the data packages coming from the various real network devices [2].

An alternative way is to provide students with a network simulation software. While simulators cannot provide students with some practical skills such as cabling or physical devices connectivity, they represent a useful and cost-effective approach to understand concepts of computer networks, protocols and applications better than traditional tools do.

There are many software tools for network protocol analysis, both in commercial and open source products. Wireshark [3] is very easy to use and free network protocol analyser. However, one of the disadvantages is that it doesn't provide visual connection between OSI model protocols of each network layer. Commercial NetSim and free GNS3 [4,5] software provide visual virtual network devices, so that they solve some problems of real network devices in network teaching. However, both of them don't provide suitable visual ways for network protocol analysis.

Cisco Packet Tracer (PT) is teaching and learning virtual networking simulation software developed by Cisco Systems Inc. and widely used by the students participating in CCNA or CCNP courses offered by Cisco Networking Academy Program (CNAP) [6]. PT provides a virtual network environment with substantially details of the network operating system on individual devices. PT allows creation of realistic scenarios of various networking structures, network system configuration and network troubleshooting. PT is a graphically based (GUI) interactive software, but it also provides students with a text-based CLI (Command Line Interface), available for configuring network devices. The CLI allows students to enter partial Cisco IOS commands.

Cisco IOS is network infrastructure software used on most Cisco routers and current switches [7].

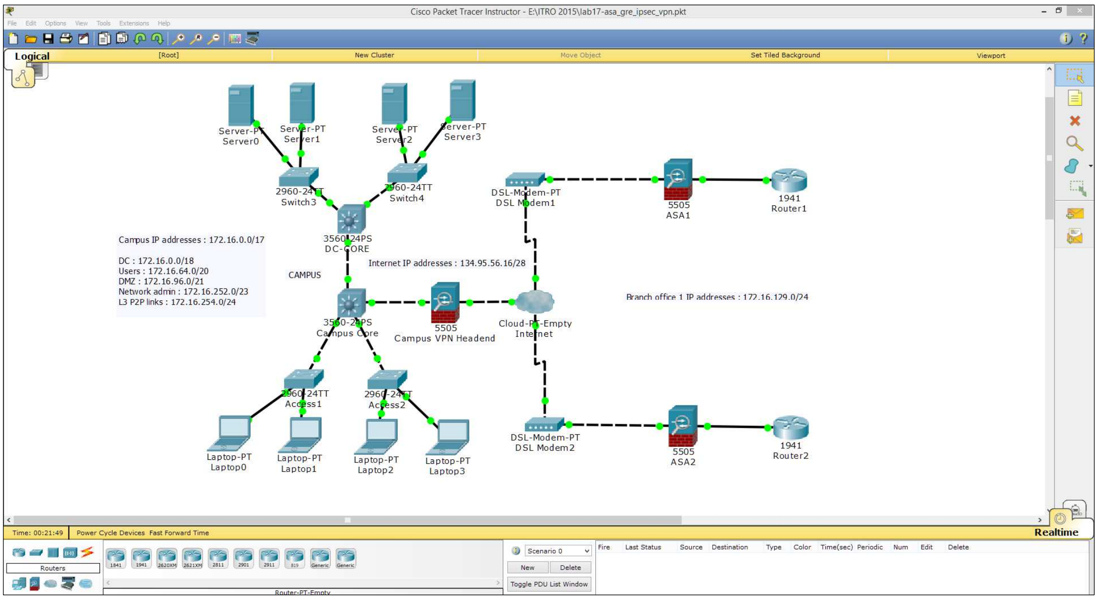

Figure 1. Packet Tracer network devices topology

II. Features of Packet Tracer 6.2

A. *New devices and protocols*

In February 2015 Packet Tracer 6.2 was released in two versions - Student and Instructor. PT 6.2 includes an ASA 5505 firewall with CLI configuration (but no ASDM or CCP tools) [8,9]. It also includes a netflow collector as a desktop application in the server device, routing protocols for IPv6 (OSPFv3, EIGRPv6, RIPng), DHCP snooping, IPv6 CEF and IPsec commands. This PT version includes a new Cisco 819 ISR router with a embedded wireless access point and some new devices: 3G/4G cell tower, Central Office (CO) server and 3G/4G support for end devices (smartphone, tablet, server etc.), [Table 1].

B. *Workspaces and operating modes*

PT has two types of workspace: logical and physical. Logical workspace allows students to build logical network topologies by placing, connecting, and clustering virtual devices. The physical workspace provides a graphical visualization of the logical network and represents how network devices would look in a real environment. The physical view enables geographic representations of networks, including multiple cities, buildings and wiring closets.

TABLE 1. PACKET TRACER 6.2 - NEW FEATURES

HTTP server (server device)
– Javascript and CSS support – HTTP and FTP linked file management support – Externel file import inside Packet Tracer HTTP server
New devices
– Cisco 819 Integrated Service Router with WLAN access point capability and 3G/4G connectivity – 3G/4G telephony cell tower – 3G/4G central office (CO) server with coaxial connectivity with up to 8 cell towers – Wired sniffer with repeater functionnality

There are two operating modes to visual representation of a network behavior: real-time and simulation mode. The real-time mode enables students to gain configuration practice because the devices in network look and behave exactly the same as real Cisco devices. In simulation mode they can see, control and analyse time intervals and propagation of data across a network, and can learn how to troubleshoot network failures. This significantly helps most of them understand the fundamental concepts behind network operations. In Figure 1 the example of the PT network devices topology map is shown. This topology represents how to create site-to-site IPSec VPN using ASA 5505 firewall. A small branch office is securely connected to the enterprise campus over the internet using a broadband DSL modem connection [10].

C. *Modular network devices*

Graphical representations visually simulate network equipment, and offer the ability to insert interface cards into Cisco modular routers and switches. Selecting switches or routers from the device-type selection box lists both Cisco devices and some devices labeled Generic. These are custom PT devices running on Cisco IOS, but the slots that hold the modules are different.

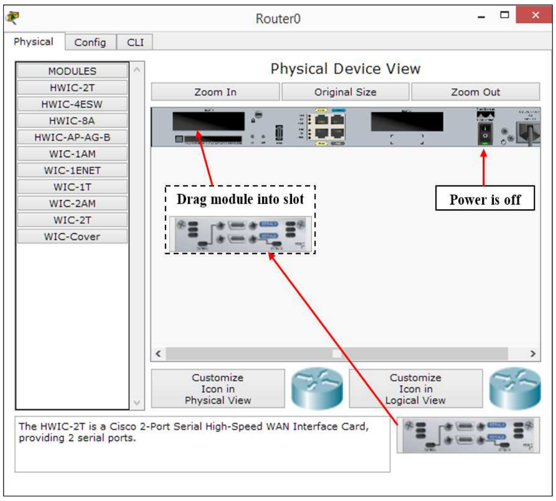

Figure 2. Setup of Cisco router with HWIC-2T module

A device module is a piece of hardware containing several device interfaces. For example, a HWIC-2T module contains two Serial High-Speed WAN ports. Similar to a real Cisco router, the virtual device has to be powered off in order to add or remove modules (Figure 2). The power switch is on the right-hand side of router, and click on this switch will turn it off. To add a module, drag it from the modules list and drop onto an empty slot. To remove a module, power off the router and drag it from the slot back to the module list.

PT is supported by a various networking devices which can be used to create different networking scenarios. Except routers and switches, they include hubs, wireless and wired end devices, WAN emulation, custom made devices, multi-user connections, PCs, laptops, servers, printers, IP phones, VoIP devices, analog phones, TVs, tablets, ASA 5505, CO servers, Cell towers etc.

D. *Device connections and settings*

Various types of cables which can be used to connect various networking devices in a PT are: console cable, copper straight-through/cross-over cable, coaxial, phone, fibre cable, Serial DTE/DCE and octal cable. After connecting devices, students can see a light at each end of the cable. This indicates the state of the connection, as follows: Bright green (physical link is up, but it doesn't indicate the status of the line protocol), Blinking green (link activity), Red (physical link is down and it can be caused by incorrect cables or by a port being administratively shut down), Amber (this appears only on switches, and indicates that the port is running the STP Spanning Tree Protocol algorithm to detect layer 2 networking loops) [11].

For the most common Cisco network devices configurations PT provides GUI setup options. The configuration window for Cisco devices, such as routers and switches, consists of three tabs. The Physical tab is used to add or remove modules. Using the Config tab, the following can be configured: Global settings, Routing (on a router or a layer 3 switch), VLAN database (on a switch) and Interface settings (Figure 3). The CLI tab is used to configure all of the device settings supported by PT in the same manner used via the command line interface on an actual device. A student can access the CLI mode of a device either by using a terminal software when a PC is connected to a router/switch using a console cable, or by using Putty, SSH or Telnet when it is connected using a crossover Ethernet cable. Packet Tracer offers a feature to save a device that students can configure as a custom-made device, with particular set of modules.

Packet Tracer 6.2 has some improvements about device clustering. A cluster is a feature of the logical workspace and hence does not affect how devices are displayed in the physical PT workspace. Because when large network topologies are created, sometimes it becomes difficult to understand them after a while. By combining several devices into a single cloud icon, students can obtain access into specific clusters and network subnets.

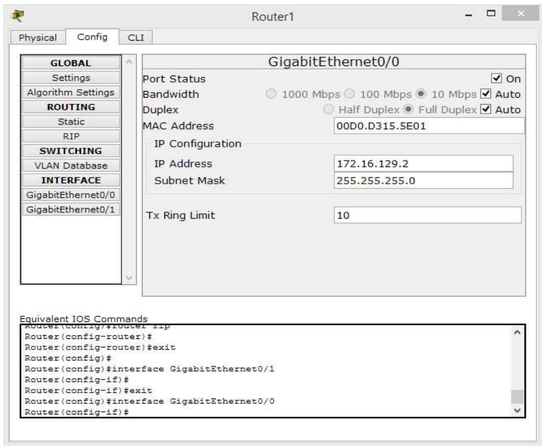

Figure 3. Configuration tab options for Cisco router

III. SIMULATION MODE AND ANALYSIS

After creating a network topology, connectivity between devices can be tested by using either simple or complex PDU (Packet Data Unit). The

PDU information window allows students to open a packet and look inside to see how it is being processed at each layer of the OSI Model. It is possible to do the same testing by pinging devices from their CLI interface, but using the PDU option is quicker for large network topologies. There are two options for PDU connectivity testing: Simple and Complex PDU. The Simple PDU uses only ICMP (Internet Control Message Protocol). Creating a Complex PDU allows student to control parameters of the packet such as: Protocol, Source and Destination IP, Port, TTL and Sequence number and also allows to test connectivity to specific interfaces on a device.

Using simulation mode, students can see and analyse packets step by step flowing from one network node to another, and can also see detailed packet information categorized by OSI layers. In this mode PT allows pause the simulation, or step forward/backward in time, and investigate many types of information on specific objects at specific times.

PT uses the Realtime/Simulation tab to switch to the simulation mode. Simulation mode has the Auto Capture/Play button to begin packet capture (Figure 4). Pressing this button all of the network traffic (chosen under event filters) being continuously captured until this button is pressed again. Capture/Forward button represents manual mode of the previous button and has to be pressed each time to move the packet from one place to another. Button Back moves the process one step back each time it is clicked on. Student can try a Simple PDU and the event list will be populated with three entries, indicating the creation of an ICMP packet, echo sent, and ICMP reply received. A timer at the bottom of the Event List window shows the total time that has elapsed since the beginning of the simulation. Constant Delay can be turned off so that actual processing delay and propagation delay is added to the simulation [12].

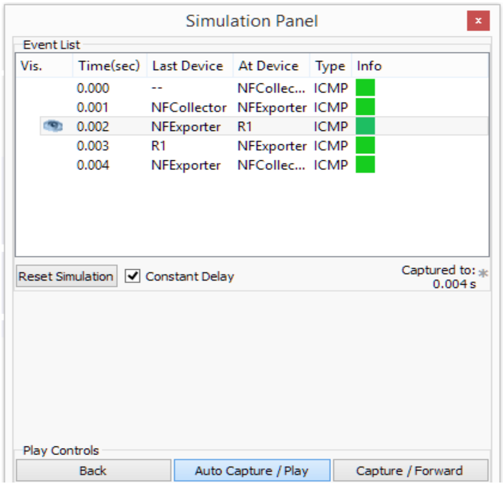

Figure 4. Event List is a part of Simulation Panel

Student can either click on the Info box for a specific PDU, or click on the PDU in the topology window to bring up the PDU Information window. The OSI Model shows the de-encapsulation and encapsulation process. Clicking on a layer will display detailed information about decisions made at that layer. The students can use OSI model tab to:

- demonstrate how switches process only to OSI Layer 2 and routers process to Layer 3
- show encapsulation/decapsulation to accommodate different interfaces
- show operation of an ACLs (Access Control Lists)
- show operation of NAT (Network Address Translation)
- show what happens to a packet with no ARP table entry
- show routing decisions about the packet either forwarding it or dropping based on routing table entries

The data for different OSI layers and the formats of network protocols can be viewed as shown in Figure 5.

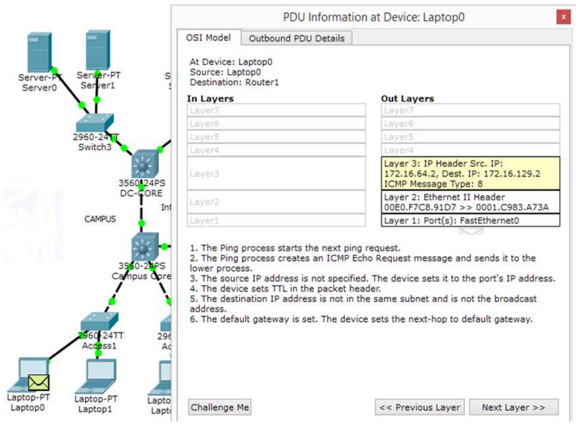

Figure 5. Layer 3 of OSI networking model

Students can quiz themselves on the encapsulation process by entering Challenge Mode. The Challenge Me button from the OSI Model tab of the PDU Information window starts Challenge Mode (Figure 5). The layer details are hidden, and the information window is replaced by a question window that asks what the device does to a PDU on a given layer. Students select from a multiple-choice list. If they answer correctly, the details for that layer are shown and the question window advances to the next layer. The Hint button provides hints.

IV. ADVANCED PACKET TRACER OPTIONS

Multiuser peer-to-peer mode of Packet Tracer 6.2 allows collaborative construction of virtual networks over a real network. The multiuser feature enables collaborative and competitive interactions, providing the option to progress from individual to social learning and features opportunities for collaboration, competition, remote instructor-student interactions, social networking and gaming [13]. This new feature has opened the door to develop many interesting new activities such as interactive and dynamic troubleshooting and serious gaming for introductory networking classes. PT multi-user activities can make networking more interesting to learn and lead to greater student engagement. The multiuser capability allows connection of remote instances of PT on separate machines [14].

The Activity Wizard guides students through the creation of an assessment. It is made accessible by navigating to Extensions>Activity Wizard. The Activity Wizard allows students to author their own learning activities by setting up scenarios using instructional text, and creating initial and final network topologies and predefined packets. Instructions in Activity Wizard are built in simple HTML format and also includes grading and feedback capabilities [15].

The physical workspace is divided into four layers to reflect the physical scale of real life environments: Intercity, City, Building and Wiring Closet. The Wiring Closet is the final layer that contains devices placed in the logical topology and it doesn't have any specified area (Figure 6).

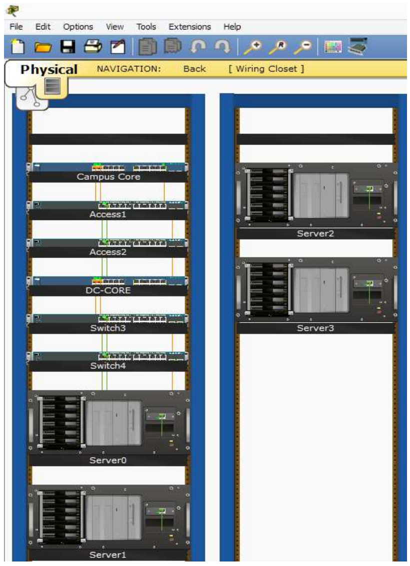

Figure 6. The physical workspace (Wiring Closet) with graphical view of network devices and connections

Packet Tracer 7.0 is under development and could include new IoE (Internet Of Everything) items and an IoE registration server. Last known build is Packet Tracer 7.0 build 70 as of 2.3.2015.

V. CONCLUSIONS

There are various benefits and advantages of using a Packet Tracer in learning basic and advanced concepts of computer networks. Because computer networks can be difficult to understand theoretically, PT has lots of features to create various scenario based labs. After doing more practice on a PT networking scenarios, students gain lot of confidence to work on real-time networking devices.

In this paper, we also presented some additional tools that can significantly help students to become more familiar with advanced computer network topologies.

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APPLICATION OF FUNDAMENTAL LEMMA OF VARIATIONAL CALCULUS TO THE BERNOULLI'S PROBLEM FOR THE SHORTEST TIME

A. Risteska, V. Kokalanov, V. Gicev
Faculty of Computer Science, Univ. Goce Delcev, Stip, Republic of Macedonia
aleksandra.risteska@ugd.edu.mk

Abstract - Variational calculus studied methods for finding maximum and minimum values of functional. It has its inception in 1696 year by Johan Bernoulli with its glorious problem: to find a curve, connecting two points A and B, which does not lie in a vertical, so that heavy point descending on this curve from position A to reach position in for at least time. In functional analysis, variational calculus takes the same space, as well as theory of maxima and minimum intensity in the classic analysis.

We will prove a theorem for functional where prove that necessary condition for extreme of functional is the variation of functional is equal to zero. We describe the solution of the equation of Euler with example of application, such as the Bernoulli's problem for the shortest time.

I. Introduction

We will explore for extreme of the functional

$$v[y(x)] = \int_{x_0}^{x_1} F(x, y(x), y'(x))\, dx \qquad (0.1)$$

With the limit points of the allowable set of curves: $y(x_0) = y_0$ and $y(x_1) = y_1$. Will we consider that the function $F(x, y, y')$ is three times differentiable. We know that necessary condition for extreme is the variation in the functional is equal to zero. We will now show how the main theorem is applied to the given functional (0.1).

Assume that extreme reached on two times differentiable curve $y = y(x)$ (required only the existence of a derived from the first line of residue curves, otherwise, it may be that of the curve on which is reached extreme, there is a second derived). We are taking some close to $y = y(x)$ limit curves $y = \overline{y}(x)$ and include curves $y = y(x)$ and $y = \overline{y}(x)$ to the family curves with one parameter

$$y(x, \alpha) = y(x) + \alpha(\overline{y}(x) - y(x)) .$$

When $\alpha = 0$ we receive the curve $y = y(x)$, when $\alpha = 1$ we receive $y = \overline{y}(x)$.

As we already know, the difference $\overline{y}(x) - y(x)$ is called variation of the function $y(x)$ and means with the δy .

The variation δy in variational problems play a role analogous to the role of the increase Δx of an independent variable x in problems for study of extreme of function $f(x)$. The variation of function $\delta y = \overline{y}(x) - y(x)$ is a function of the x.

This function can be differentiated one or several times, as $(\delta y)' = \overline{y}'(x) - y'(x) = \delta y'$ it is generated of the variance is equal to the variance of the generated, and similarly

$$(\delta y)'' = \overline{y}''(x) - y''(x) = \delta y'',$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$(\delta y)^{(k)} = \overline{y}^{(k)}(x) - y^{(k)}(x) = \delta y^{(k)}.$$

And so, we analyze the family $y = y(x, \alpha)$, where $y(x, \alpha) = y(x) + \alpha \delta y$, containing the $\alpha = 0$ curves, of which reaches an extreme, and in some $\alpha = 1$ close tolerances and curves that are called curves of comparison.

If we look at the values of functional (0.1), only of the family curves $y = y(x, \alpha)$, it the functional turned into function of α :

$$v[y(x, \alpha)] = \varphi(\alpha),$$

As in the case that we consider $v[y(x,\alpha)]$ is functional depending on parameter, the value of the parameter α determines the curve of the family $y = y(x,\alpha)$ and so determined and the value of functional $v[y(x,\alpha)]$.

Theorem 1.

If functional $v(y) = \int_{x_0}^{x_1} F(x, y, y')dx$ has a local extreme in y , the necessary condition for extreme of functional is

$$\int_{x_0}^{x_1} [F_y - \frac{d}{dx} F_{y'}]\delta y \, dx = 0, \quad (0.2)$$

Proof of theorem 1 .

We analyze the function $\varphi(\alpha)$. It reaches its extreme at $\alpha = 0$, and when $\alpha = 0$ we receive $y = y(x)$, and the functional, in assumption, reaches extreme compared with any permissible curve, and in particular, in terms of the nearly families curves $y = y(x,\alpha)$.

Necessary condition for extreme of the function $\varphi(\alpha)$ at $\alpha = 0$, as is known, is its a derivative is equal to zero at $\alpha = 0$, i.e.

$$\varphi'(0) = 0 \ .$$

Since

$$\varphi(\alpha) = \int_{x_0}^{x_1} F(x, y(x,\alpha), y_x'(x,\alpha)) \, dx,$$

It

$$\varphi'(\alpha) = \int_{x_0}^{x_1} \left[F_y' \frac{\partial}{\partial\alpha} y(x,\alpha) + F_{y'}' \frac{\partial}{\partial\alpha} y'(x,\alpha) \right] dx,$$

Where

$$F_y' = \frac{\partial}{\partial y} F(x, y(x,\alpha), y'(x,\alpha)),$$

$$F_{y'}' = \frac{\partial}{\partial y'} F(x, y(x,\alpha), y'(x,\alpha)),$$

$$\frac{\partial}{\partial\alpha} y(x,\alpha) = \frac{\partial}{\partial\alpha}[y(x) + \alpha\delta y] = \delta y$$

$$\frac{\partial}{\partial\alpha} y'(x,\alpha) = \frac{\partial}{\partial\alpha}[y'(x) + \alpha\delta y'] = \delta y',$$

And we get

$$\varphi'(\alpha) = \int_{x_0}^{x_1} \left[F_y(x, y(x,\alpha), y'(x,\alpha))\delta y + F_{y'}(x, y(x,\alpha), y'(x,\alpha))\delta y' \right] dx,$$

$$\varphi'(0) = \int_{x_0}^{x_1} \left[F_y(x, y(x), y'(x))\delta y + F_{y'}(x, y(x), y'(x))\delta y' \right] dx \quad (npu \ \alpha = 0).$$

As we know, $\varphi'(0)$ is called variation of functional and means δv.

Necessary condition for extreme of functional is its variation is equal to zero

$$\delta v = 0 \ .$$

For the functional (0.1) this condition has a type of

$$\int_{x_0}^{x_1} [F_y' \delta y + F_{y'}' \delta y'] \, dx = 0 \quad (0.3)$$

Integrate the equation (0.3) in parts, whereas $\delta y' = (\delta y)'$, we get

$$\delta v = [F'_{y'}\delta y']\Big|_{x_0}^{x_1} + \int_{x_0}^{x_1} [F_y' - \frac{d}{dx}F'_{y'}]\delta y\, dx =$$

$$= \int_{x_0}^{x_1} F'_y \delta y\, dx + F'_{y'}(x_1, y(x_1,\alpha), y'(x_1,\alpha))\delta y(x_1) - F'_{y'}(x_0, y(x_0,\alpha), y'(x_0,\alpha))\delta y(x_0) =$$

$$= \int_{x_0}^{x_1} F'_y \delta y\, dx + F'_{y'}(x_1, y(x_1,\alpha), y'(x_1,\alpha))(\bar{y}(x_1) - y(x_1))$$

$$- F'_{y'}(x_0, y(x_0,\alpha), y'(x_0,\alpha))(\bar{y}(x_0) - y(x_0)) - \int_{x_0}^{x_1} (\delta y) dF'_{y'} =$$

$$= \int_{x_0}^{x_1} F'_y \delta y\, dx + F'_{y'}(x_1, y(x_1,\alpha), y'(x_1,\alpha))(0)$$

$$- F'_{y'}(x_0, y(x_0,\alpha), y'(x_0,\alpha))(0) - \int_{x_0}^{x_1} (\delta y) \frac{d}{dx}F'_{y'}$$

Since, all of the possible (permissible) curves in the given problem pass through fixed limit points, we get

$$\delta v = \int_{x_0}^{x_1} [F_y' - \frac{d}{dx}F'_{y'}]\delta y\, dx \ .$$

Note.

The first multiplier $F_y' - \frac{d}{dx}F'_{y'}$ of the curve $y = y(x)$ reaches extreme of the continuous function, and the second multiplier δy , random for the choice of the curve in comparison $y = \bar{y}(x)$, is arbitrary function having passed only certain general conditions, namely: the function δy in the border points $x = x_0$, and $x = x_1$ is equal to zero, continuous and differentiable one or several times, δy or δy and $\delta y'$ are small in absolute value.

To simplify the obtained necessary condition (0.2), we will use the following lemma:

Fundamental lemma of the variational calculus

If for any continuous function $\eta(x)$ is true

$$\int_{x_0}^{x_1} \Phi(x)\eta(x)\, dx = 0,$$

Where the function $\Phi(x)$ is continuous in the interval $[x_0, x_1]$, it

$\Phi(x) \equiv 0$ in this interval.

Proof of the fundamental lemma of variational calculus

We accept that, in the point $x = \bar{x}$, resting in the interval (x_0, x_1) , $\Phi(x) \neq 0$, is a contradiction.

Indeed, the continuity of the function $\Phi(x)$, it follows that if $\Phi(\bar{x}) \neq 0$ it $\Phi(x)$ keeps characters in vicinity of $\bar{x}$ ($x_0 \leq x \leq x_1$). We choose function $\eta(x)$ which also retains the mark in that vicinity and is equal to zero outside of this vicinity. We receive

$$\int_{x_0}^{x_1} \Phi(x)\eta(x)\, dx = \int_{\bar{x}_0}^{\bar{x}_1} \Phi(x)\eta(x)\, dx \neq 0,$$

Since product $\Phi(x)\eta(x)$ retains its mark in the interval $x_0 \leq x \leq x_1$ and is equal to zero in the same interval.

And so, we come to a contradiction, therefore $\Phi(x) \equiv 0$.

$\square$

Note .

Adoption of lemma and its proof remain unchanged if the function $\eta(x)$ requires the following restrictions:

$$\eta(x_0) = \eta(x_1) = 0,$$

$\eta(x)$ There is a continuous derived to line n ,

$$\left|\eta^{(s)}(x)\right| < \varepsilon, \quad (s = 0,1,\ldots,q; q \le n) \ .$$

The function $\eta(x)$ can be selected, e.g. :

$$\eta(x) = \begin{cases} k(x-\bar{x}_0)^{2n}(x-\bar{x}_1)^{2n}, & x \in [\bar{x}_0, \bar{x}_1] \\ 0 & x \in [x_0, x_1] \setminus [\bar{x}_0, \bar{x}_1] \end{cases},$$

where n is a positive number, k is a constant.

Apparently, that the function $\eta(x)$ satisfies the above conditions: it is a continuous, there is a continuous derived to line $2n-1$, in the points x_0 and x_1 is equal to zero and by reducing the factor by k we can do $\left|\eta^{(s)}(x)\right| < \varepsilon$ for the $\forall x \in [x_0, x_1]$. Now we will apply the fundamental lemma of variational calculus to simplify the above necessary condition for extreme (0.2) of functional (0.1).

Consequence1.1.

If functional $v(y) = \int_{x_0}^{x_1} F(x, y, y')dx$ reaches extreme of the curve $y = y(x)$, and F_y' and are $\frac{d}{dx}F_{y'}'$ continuous, then it $y = y(x)$ is a solution to the differential equation (equation of Euler)

$$F_y - \frac{d}{dx}F_{y'} = 0,$$

Or in an expanded form

$$F_y - F_{xy'} - F_{yy'}y' - F_{y'y'}y'' = 0 \ .$$

Proof of consequence 1.1 .

The proof of consequence 1.1 follows immediately from the fundamental lemma of variational calculus.

□

This equation is called equation of Euler (1744 year). Integral curve $y = y(x, C_1, C_2)$ equation of Euler is called extreme.

To find a curve, which is reached extreme of functional (0.1) we integrate the equation of Euler and spell out random constants, satisfying the general solution of this equation, of the conditions of borders $y(x_0) = y_0, y(x_1) = y_1$.

Only if they are satisfied with these conditions, can be reached extreme of functional.

However, in order to determine whether they are really extreme (maximum or minimum), must be studied and sufficient conditions for extreme.

To recall, that border problem

$$F_y' - \frac{d}{dx}F_{y'}' = 0, \quad y(x_0) = y_0, \quad y(x_1) = y_1 ,$$

not always, has a solution, and if there is a solution, then this may not be sole.

It should be taken into account that in many variational problems the existence of solutions is evident, from physical or geometrical sense of the problem, and in the solution of the equations of Euler satisfying the border conditions, only a single extreme may be the solution of the given problem.

II. Bernoulli 's Problem for the Shortest Time

Two points, which are at different distances from the ground and not in a vertical line, must be connected to a curve such as

$$y = y(x),$$

that body under the influence of gravitational forces pass in the shortest possible time from the upper to the lower point. We are going to calculate this curve and show that this corresponds to the variation task:

$$\int_0^a \frac{\sqrt{1+y'^2}}{\sqrt{-y}}dx = \min, \quad y(0) = 0, \quad y(a) = -h$$

Solution:

Time to passage from a point p_1 , which is higher than that, which is less than p_2 is given by the integral

$$t_{12} = \int_{p_1}^{p_2} \frac{ds}{v},$$

where s is the arc length and v is speed. Velocity at each point may be obtained by applying the principle of converting kinetic energy into potential gravitational energy.

$$\Rightarrow \quad \frac{1}{2}mv^2 = mgy,$$

from which we get $v = \sqrt{2gy}$.

From the equality

$$ds = \sqrt{dx^2 + dy^2} = \sqrt{1+(y')^2}\,dx$$

and substituting in the integral we get

$$t_{1,2} = \int_{p_1}^{p_2} \frac{\sqrt{1+(y')^2}}{\sqrt{2gy}}\,dx =$$

$$= \int_{p_1}^{p_2} \sqrt{\frac{1+(y')^2}{2gy}}\,dx$$

$$\Rightarrow \quad f = (1+y'^2)^{1/2}(2gy)^{-1/2}$$

Now we are applying Euler equation

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$$

From $\frac{\partial f}{\partial x} = 0$, we can use the equality of Bernoulli

$$f - y'\frac{\partial f}{\partial y'} = const$$

$$\Rightarrow \quad \frac{\partial f}{\partial y'} = y'(1+y'^2)^{-1/2}(2gy)^{-1/2}$$

$$\Rightarrow \quad (1+y'^2)^{-1/2}(2gy)^{-1/2} - y'.y'(1+y'^2)^{-1/2}(2gy)^{-1/2} = c$$

$$\Rightarrow \quad (2gy)^{-1/2}\left[(1+y'^2)^{-1/2} - y'^2(1+y'^2)^{-1/2}\right] = c$$

$$\Rightarrow \quad \frac{\left[(1+y'^2)^{-1/2} - y'^2(1+y'^2)^{-1/2}\right](1+y'^2)^{-1/2}}{\sqrt{2gy}\sqrt{1+y'^2}} = c$$

$$\Rightarrow \quad \frac{(1+y'^2)^1 - y'^2(1+y'^2)^0}{\sqrt{2gy}\sqrt{1+y'^2}} = c$$

$$\Rightarrow \quad \frac{1}{\sqrt{2gy}\sqrt{1+y'^2}} = c$$

$$\Rightarrow \quad \frac{1}{\sqrt{2gy}.c} = \sqrt{1+y'^2} \qquad \Big|^2$$

$$\Rightarrow \quad \frac{1}{2gy.c^2} = 1+y'^2$$

$$\Rightarrow \quad \left[1+\left[\frac{dy}{dx}\right]^2\right]y = \frac{1}{2gy.c^2}, \qquad k^2 = 2gy.c^2 \; (0.1)$$

Therefore, the solution of (0.4) is a cycloid

$$x = \frac{1}{2}k^2(\theta - \sin\theta)$$

$$y = \frac{1}{2}k^2(1 - \cos\theta)$$

III. CONCLUSION

It should be taken into account that in many variational problems the existence of solutions is evident, from physical or geometrical sense of the problem, and in the solution of the equations of Euler satisfying the border conditions, only a single extreme may be the solution of the given problem.

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APPLICATION OF FUNDAMENTAL LEMMA OF VARIATIONAL CALCULUS TO THE PROBLEM FOR THE BRACHISTOCHRONE

A. Risteska, V. Kokalanov, V. Gicev
Faculty of Computer Science, Universiti Goce Delcev, Stip, Macedonia
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Abstract - Variational calculus studied methods for finding maximum and minimum values of functional. It has its inception in 1696 year by Johan Bernoulli with its glorious problem for the brachistochrone: to find a curve, connecting two points A and B , which does not lie in a vertical, so that heavy point descending on this curve from position A to reach position in for at least time. In functional analysis, variational calculus takes the same space, as well as theory of maxima and minimum intensity in the classic analysis.

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I. INTRODUCTION

We will explore for extreme of the functional

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With the limit points of the allowable set of curves: $y(x_0) = y_0$ and $y(x_1) = y_1$. Will we consider that the function $F(x, y, y')$ is three times differentiable. We know that necessary condition for extreme is the variation in the functional is equal to zero. We will now show how the main theorem is applied to the given functional (0.1).

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When $\alpha = 0$ we receive the curve $y = y(x)$, when $\alpha = 1$ we receive $y = \overline{y}(x)$.

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Since

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It

$$\varphi'(\alpha) = \int_{x_0}^{x_1} \left[F_y' \frac{\partial}{\partial \alpha} y(x,\alpha) + F_{y'}' \frac{\partial}{\partial \alpha} y'(x,\alpha)) \right] dx,$$

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$$\frac{\partial}{\partial \alpha} y(x,\alpha) = \frac{\partial}{\partial \alpha}[y(x) + \alpha\delta y] = \delta y$$

$$\frac{\partial}{\partial \alpha} y'(x,\alpha) = \frac{\partial}{\partial \alpha}[y'(x) + \alpha\delta y'] = \delta y',$$

And we get

$$\varphi'(\alpha) = \int_{x_0}^{x_1} \left[F_y(x, y(x,\alpha), y'(x,\alpha))\delta y + F_{y'}(x, y(x,\alpha), y'(x,\alpha))\delta y' \right] dx,$$

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Integrate the equation (0.3) in parts, whereas $\delta y' = (\delta y)'$, we get

$$\delta v = [F'_{y'} \delta y']\Big|_{x_0}^{x_1} + \int_{x_0}^{x_1} [F_y' - \frac{d}{dx} F'_{y'}] \delta y \, dx =$$

$$= \int_{x_0}^{x_1} F'_y \delta y \, dx + F'_{y'}(x_1, y(x_1,\alpha), y'(x_1,\alpha)) \delta y(x_1) - F'_{y'}(x_0, y(x_0,\alpha), y'(x_0,\alpha)) \delta y(x_0) =$$

$$= \int_{x_0}^{x_1} F'_y \delta y \, dx + F'_{y'}(x_1, y(x_1,\alpha), y'(x_1,\alpha))(\overline{y}(x_1) - y(x_1))$$

$$-F'_{y'}(x_0, y(x_0,\alpha), y'(x_0,\alpha))(\overline{y}(x_0) - y(x_0)) - \int_{x_0}^{x_1} (\delta y) dF'_{y'} =$$

$$= \int_{x_0}^{x_1} F'_y \delta y \, dx + F'_{y'}(x_1, y(x_1,\alpha), y'(x_1,\alpha))(0)$$

$$-F'_{y'}(x_0, y(x_0,\alpha), y'(x_0,\alpha))(0) - \int_{x_0}^{x_1} (\delta y) \frac{d}{dx} F'_{y'}$$

Since, all of the possible (permissible) curves in the given problem pass through fixed limit points, we get

$$\delta v = \int_{x_0}^{x_1} [F_y' - \frac{d}{dx} F'_{y'}] \delta y \, dx$$

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Note.

The first multiplier $F_y' - \frac{d}{dx} F'_{y'}$ of the curve $y = y(x)$ reaches extreme of the continuous function, and the second multiplier δy, random for the choice of the curve in comparison $y = \overline{y}(x)$, is arbitrary function having passed only certain general conditions, namely: the function δy in the border points $x = x_0$, and $x = x_1$ is equal to zero, continuous and differentiable one or several times, δy or δy and $\delta y'$ are small in absolute value.

To simplify the obtained necessary condition (0.2), we will use the following lemma:

Fundamental lemma of the variational calculus

If for any continuous function $\eta(x)$ is true

$$\int_{x_0}^{x_1} \Phi(x) \eta(x) \, dx = 0,$$

Where the function $\Phi(x)$ is continuous in the interval $[x_0, x_1]$, it

$$\Phi(x) \equiv 0$$

in this interval.

Proof of the fundamental lemma of variational calculus

We accept that, in the point $x = \overline{x}$, resting in the interval (x_0, x_1), $\Phi(x) \neq 0$, is a contradiction.

Indeed, the continuity of the function $\Phi(x)$, it follows that if $\Phi(\overline{x}) \neq 0$ it $\Phi(x)$ keeps characters in vicinity of $\overline{x}$ ($x_0 \le x \le x_1$). We choose function $\eta(x)$ which also retains the mark in that vicinity and is equal to zero outside of this vicinity. We receive

$$\int_{x_0}^{x_1} \Phi(x)\eta(x) \, dx = \int_{\overline{x}_0}^{\overline{x}_1} \Phi(x)\eta(x) \, dx \neq 0,$$

Since product $\Phi(x)\eta(x)$ retains its mark in the interval $x_0 \le x \le x_1$ and is equal to zero in the same interval.

And so, we come to a contradiction, therefore $\Phi(x) \equiv 0$.

Note .

Adoption of lemma and its proof remain unchanged if the function $\eta(x)$ requires the following restrictions:

$$\eta(x_0) = \eta(x_1) = 0,$$

$\eta(x)$ There is a continuous derived to line n ,

$$\left|\eta^{(s)}(x)\right| < \varepsilon, \quad (s = 0,1,\ldots,q; q \le n)$$

The function $\eta(x)$ can be selected, e.g. :

$$\eta(x) = \begin{cases} k(x-\bar{x}_0)^{2n}(x-\bar{x}_1)^{2n}, & x \in [\bar{x}_0, \bar{x}_1] \\ 0 & x \in [x_0, x_1] \setminus [\bar{x}_0, \bar{x}_1] \end{cases} ,$$

where n is a positive number, k is a constant.

Apparently, that the function $\eta(x)$ satisfies the above conditions: it is a continuous, there is a continuous derived to line $2n-1$, in the points x_0 and x_1 is equal to zero and by reducing the factor by k we can do $\left|\eta^{(s)}(x)\right| < \varepsilon$ for the $\forall x \in [x_0, x_1]$.

Now we will apply the fundamental lemma of variational calculus to simplify the above necessary condition for extreme (0.2) of functional (0.1).

Consequence1.1.

If functional $v(y) = \int_{x_0}^{x_1} F(x, y, y')dx$ reaches extreme of the curve $y = y(x)$, and F_y' and are $\frac{d}{dx}F_{y'}'$ continuous, then it $y = y(x)$ is a solution to the differential equation (equation of Euler)

$$F_y - \frac{d}{dx}F_{y'} = 0,$$

Or in an expanded form

$$F_y - F_{xy'} - F_{yy'}y' - F_{y'y'}y'' = 0 .$$

Proof of consequence 1.1 .

The proof of consequence 1.1 follows immediately from the fundamental lemma of variational calculus.

This equation is called equation of Euler (1744 year). Integral curve $y = y(x, C_1, C_2)$ equation of Euler is called extreme.

To find a curve, which is reached extreme of functional (0.1) we integrate the equation of Euler and spell out random constants, satisfying the general solution of this equation, of the conditions of borders $y(x_0) = y_0, y(x_1) = y_1$.

Only if they are satisfied with these conditions, can be reached extreme of functional.

However, in order to determine whether they are really extreme (maximum or minimum), must be studied and sufficient conditions for extreme.

To recall, that border problem

$$F_y' - \frac{d}{dx}F_{y'}' = 0, \quad y(x_0) = y_0, \quad y(x_1) = y_1 ,$$

not always, has a solution, and if there is a solution, then this may not be sole.

It should be taken into account that in many variational problems the existence of solutions is evident, from physical or geometrical sense of the problem, and in the solution of the equations of Euler satisfying the border conditions, only a single extreme may be the solution of the given problem.

Problem of the brachistochrone:

To determine curve, connecting two given points A and B, in whose movement, material item provided for the shortest time from A point to point B (friction and resistance of the environment). We will shift the origin of the coordinate system in the point A, the axis Ox we will put horizontally, and the axis Oy, vertically. Speed of movement of the stock point is $\frac{ds}{dt} = \sqrt{2gy}$, where we find the time spent in the movement of the point from position A(0,0) to position $B(x_1, y_1)$:

$$t[y(x)] = \frac{1}{\sqrt{2g}} \int_0^{x_1} \frac{\sqrt{1+y'^2}}{\sqrt{y}} dx; \quad y(0) = 0, y(x_1) = y_1$$

Since this functional is one of the simplest types, and the integrand function does not contain x, so the equation of Euler has a first integral

$$F - y'F_{y'}' = C ,$$

or in this case,

$$\frac{\sqrt{1+y'^2}}{\sqrt{y}}-\frac{y'^2}{\sqrt{y\left(1+y'^2\right)}}=C$$,

where after a simplification,

$$\frac{1+y'^2-y'^2}{\sqrt{y\left(1+y'^2\right)}}=C$$,

we have

$$\frac{1}{\sqrt{y\left(1+y'^2\right)}}=C$$, or $y(1+y'^2)=C_1$.

We're introducing parameter t by the application $y'=ctgt$. Therefore, we have

$$y=\frac{C_1}{1+ctg^2 t}=C_1\sin^2 t=\frac{C_1}{2}(1-\cos^2 t);$$

$$dx=\frac{dy}{y'}=\frac{2C_1\sin t\cos tdt}{ctgt}=2C_1\sin^2 tdt=$$
$$=2C_1\frac{1}{2}(1-\cos 2t)dt=C_1(1-\cos 2t)dt;$$

Integrate, and obtain

$$x=C_1\left(t-\frac{\sin 2t}{2}\right)+C_2=\frac{C_2}{2}(2t-\sin 2t)+C_2$$

The equation of the curve in parametric form has the type

$$x-C_2=\frac{C_1}{2}(2t-\sin 2t),$$
$$y=\frac{C_1}{2}(1-\cos 2t)$$

If replace for parameter $2t=t_1$, and take into account that the $C_2=0$, $x=0$, $y=0$, it receive equation of family cycloids in normal form:

$$x=\frac{C_1}{2}(t_1-\sin t_1),$$
$$y=\frac{C_1}{2}(1-\cos t_1),$$

where $\frac{C_1}{2}$ is radius of the rolling circle, which is determined by the conditions of the passing cycloid through the point $B(x_1,y_1)$.

And so, the brachistochrone is cycloid.

II. CONCLUSION

It should be taken into account that in many variational problems the existence of solutions is evident, from physical or geometrical sense of the problem, and in the solution of the equations of Euler satisfying the border conditions, only a single extreme may be the solution of the given problem.

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METHODICAL ANALYSIS OF THE CONTINUITY OF THE FUNCTION USING ILLUSTRATION METHOD IN GEOGEBRA

D. Pešić*, A. Pešić**
*Information Technology School, ComTrade Technology Centre, Belgrade, Republic of Serbia
**Faculty of Business and Industrial Management, Union University, Belgrade, Republic of Serbia
duska.pesic@its.edu.rs

Abstract - The purpose of this paper is to introduce a model of detailed methodical analysis of continuity of some functions in points from their domain, and particularly, to cultivate mathematical ingenuity and creativity by visual guiding through the complexity of this demanding concept. In that sense, we propose usage of pictures and animations created in mathematical software – GeoGebra for determining the value of δ for different values of ε, and for drawing conclusions about continuity of analysed functions.

I. Introduction

Considering the fact that students typically do not have a clear and consistent idea about the concept of continuity, a wide range of biases and misconceptions may potentially be present in students intuitive thinking about the continuous function. [7]

Assuming that appropriate visual explanations might be of great help in building an accurate and complete understanding of the concept of continuity [3] and specifically "ε - δ definition", in this paper we propose a visual presentation in teaching-learning process using Geogebra platform.

Generally, Geogebra is freeware, downloadable software that combines geometry and algebra as equal mathematical partners in its representations. Namely, GeoGebra could be used as a dynamic geometry system but it also provides an insight into the relationship between the geometric aspects of figures and their algebraic representations. [1]

In that sense, GeoGebra is a form of freely-available open-source software that provides an adequate tool for visualizing mathematical problems from elementary through university level. [2]

Aditionally, the software is also suitable for the broader range of students because it is free for educational use so that students can install and use it at home (or elsewhere, such as in a library with internet access).

Edwards and Jones argued that "perhaps utilising GeoGebra could inspire a change from regular forms of enrichment/ extension activity to things that need high level thinking and things that students may find themselves wanting to follow-up outside school lessons". [1]

II. Definition

This section provides a description of visual analysis of continuity of the function based on the "ε - δ definition" (Definition 1).

Definition 1. A function $f : D_f \to R, D_f \subset R$ is continuous at the point $x_0 \in D_f$ if:

$$(\forall \varepsilon > 0)(\exists \delta > 0)(\forall x \in D_f)$$

$$(|x - x_0| < \delta \Rightarrow |f(x) - f(x_0)| < \varepsilon) \quad (1)$$

The following procedure of visual analysis of continuity of the function $f : D_f \to R, D_f \subset R$ at the point $x_0 \in D_f$ is proposed: [4]

I – We select any $\varepsilon > 0$ and observe the interval $(f(x_0) - \varepsilon, f(x_0) + \varepsilon)$;

II – We prove the existence of at least one number $\delta > 0$ in which case the implication (1) is valid.

IIIa – If we show that procedure which proved the existence of the number δ in the second step could be applied for each $\varepsilon > 0$ [1], then the observed function is continuous.

IIIb – If we prove that, for some $\varepsilon > 0$, there is no $\delta > 0$ for which the implication (1) is valid (ie. if we find counterexamples), then we conclude that the function has a break at that point.

III. Analysis of the Tasks

Example 1. Examine the continuity of the function $f(x) = 2x - 1$ at a point $x_0 = 2$.

In GeoGebra, a graph is obtained by entering the corresponding function in the input field (Input). The graph can be seen in a special graphical view, and analytical window allows us to form an analytical tool (Figure 1). Since $f(2) = 3$, auxiliary dashed segments are entered in order to indicate the coordinates of the point at which we examine the continuity of the function f.

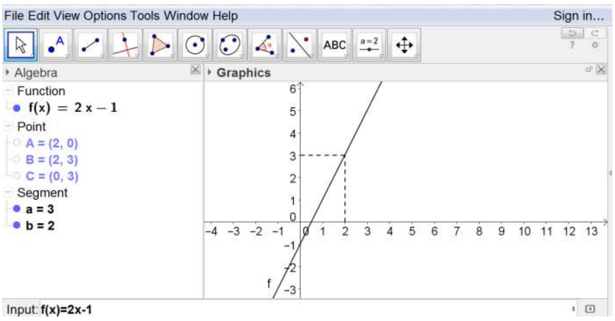

Figure 1. Data input in Geogebra

Next, we select any $\varepsilon > 0$. In GeoGebra, we can change the values of this parameter in desired interval using a slider. Since ε represents designation for “small” positive real number, it is enough to observe interval $[0,1]$.

Inserting a slider in GeoGebra is performed in the following way: firstly, we select the icon slider (Figure 2), and then click anywhere on the plane.

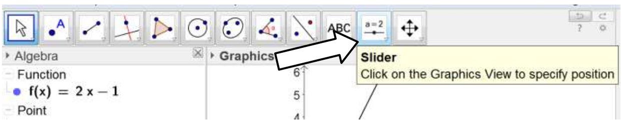

Figure 2. Inserting the slider in GeoGebra

Additional options of sliders are changed in a separate menu (we can change name, interval [min, max], increment of the number or angle, etc.) (Figure 3)

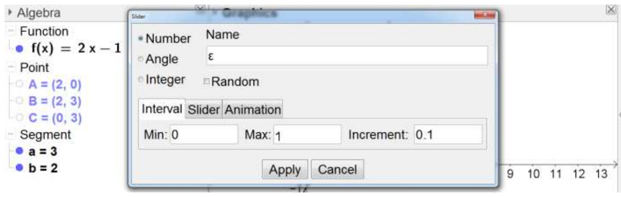

Figure 3. Adjusting the slider

It is necessary to insert another parameter for slider $\delta > 0$ (Figure 4).

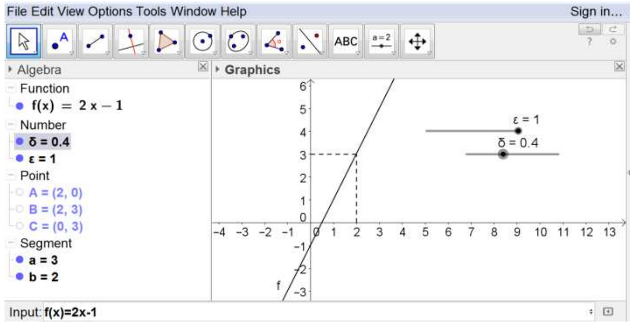

Figure 4. Parameters in GeoGebra

Then, we draw lines whose equations are:

- $y = f(x_0) - \varepsilon$;
- $y = f(x_0) + \varepsilon$;
- $x = x_0 - \delta$;
- $x = x_0 + \delta$. (Figure 5)

By simply moving the point on the slider, parameter values are changed, which causes that the lines move translatory.

It is also possible to automatically animate slider. In that case the values are automatically changed from the smallest to the largest defined value with given increment.

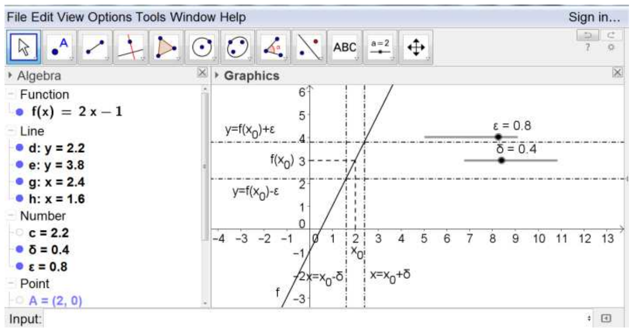

Figure 5. Connecting parameters with functions in GeoGebra

The next step is to enter two vertical lines whose equations are:

- $x = f^{-1}\left(f(x_0) - \varepsilon\right)$;

---

[1] It is not always necessary to give the process of finding the number δ, it is important that it exists.

- $x = f^{-1}\left(f\left(x_0\right)+\varepsilon\right)$.

Between those two lines (vertical full lines in Figue 6) there are all points $\left(x, f\left(x\right)\right)$ in the plane for which:

$$x \in \left(f^{-1}\left(f\left(x_0\right)-\varepsilon\right), f^{-1}\left(f\left(x_0\right)+\varepsilon\right)\right) \quad . \quad (2)$$

This part of plane is denoted as “area for checking the continuity of the function”. (filled area in Figure 6)

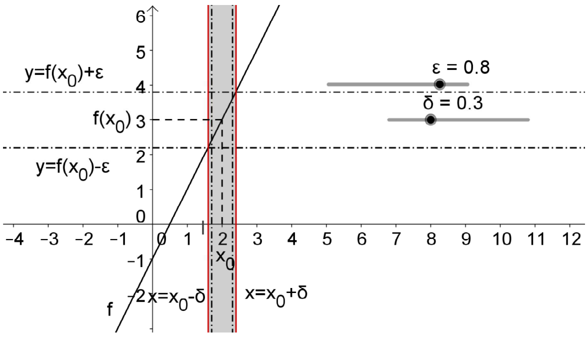

Figure 6. Area for checking the continuity of the function

In the case of linear function, interval (2) is symmetrical with respect to a point $x_0 = 2$. It must be emphasized to the students that this may not always be the case.

In further analysis we check whether vertical lines whose equations are: $x = x_0 - \delta$ and $x = x_0 + \delta$ belong to the vertical area for checking the continuity of the function. If so, then for each x which is at the distance from the point x_0 less than δ, it is satisfied that $f\left(x\right)$ is at the distance from $f\left(x_0\right)$ less than ε, because $(x_0 - \delta, x_0 + \delta)$ is subset of interval (2), ie. for those ε and δ implication (1) holds.

When vertical lines whose equations are $x = x_0 - \delta$ and $x = x_0 + \delta$ coincide with vertical lines that limit the area for checking the continuity of the function, then value of the parameter δ is maximal value for which those lines belong to the vertical area (eg. in the case when $\varepsilon = 0.8$, then $\delta = 0.4$ (Figure 7)).

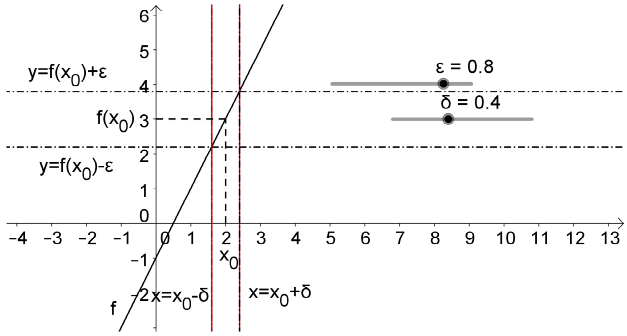

Figure 7. The search for the maximal value of the parameter δ for which the implication (1) is valid– Example 1

Changing the slider’s value we can conclude that for each $\varepsilon > 0$ there is $\delta = \frac{\varepsilon}{2}$ such that: when $x \in \left(2 - \frac{\varepsilon}{2}, 2 + \frac{\varepsilon}{2}\right)$, then:

$$f\left(x\right) \in \left(f\left(2\right)-\varepsilon, f\left(2\right)+\varepsilon\right),$$

ie. the function f is continuous at the point $x_0 = 2$.

Example 2. Examine the continuity of the function $f(x) = x^2$ at a point $x_0 = 1$.

We select any $\varepsilon > 0$. Using slider in GeoGebra alows us to easily change the values of this parameter. For example, we can choose $\varepsilon = 1$.

Since the point at which we examines the continuity is $x_0 = 1 > 0$, it is sufficient to observe the values $x > 0$.

If $x > 0$, then $f^{-1}\left(x\right) = \sqrt{x}$. In that case, interval $\left(f^{-1}\left(f\left(x_0\right)-\varepsilon\right), f^{-1}\left(f\left(x_0\right)+\varepsilon\right)\right)$ is not symmetrical with respect to the point $x_0 = 1$ (interval $\left(0, \sqrt{2}\right)$ - Figure 8).

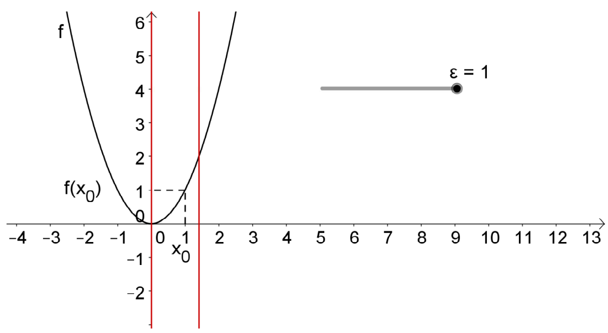

Figure 8. Assymetric interval

In order to find the appropriate value of the parameter δ, it is necessary to take a less distance (Figure 9):

$$\min\left\{\left|x_0 - f^{-1}\left(f\left(x_0\right)-\varepsilon\right)\right|,\left|x_0 - f^{-1}\left(f\left(x_0\right)+\varepsilon\right)\right|\right\}$$

$$\delta = \min\left\{\left|1-0\right|,\left|1-\sqrt{2}\right|\right\} = \sqrt{2}-1$$

For such selected δ stands:

$$\left(\sqrt{2}-1,\sqrt{2}\right)\subset\left(0,2\right).$$

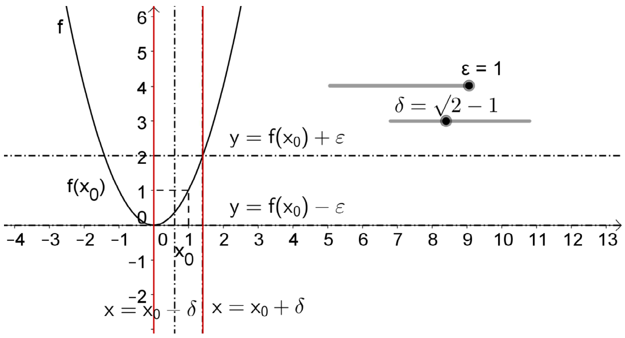

Figure 9. The search for the maximal value of the parameter δ for which the implication (1) is valid– Example 2

When we further reduce the value for ε, eg. $\varepsilon = 0.5$, it is also necessary to change the value for δ. Then, $\delta = \sqrt{1.5}-1$ (Figure 10).

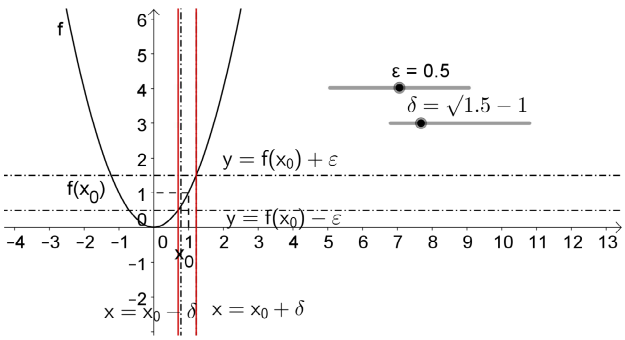

Figure 10. The search for the new values of the parameter δ

We can observe that conditions from the definition could be fulfilled for any value of the parameter δ for which stands that $\delta \le \sqrt{1.5}-1$.

Conclusion is that for any $\varepsilon > 0$ there is $\delta = \sqrt{1+\varepsilon}-1$ for which all the requirements of the definition are fulfilled, ie. observed function is continuous at a given point.

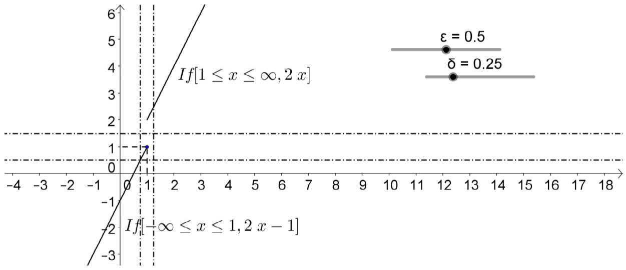

Figure 11. Discontinuous function

Example 3. Examine the continuity of the function $f(x)=\begin{cases}2x-1 & if \quad x\le 1\\ 2x & if \quad x>1\end{cases}$ at a point $x_0 = 1$.

It is obvious that for any $\varepsilon \le 1$ (eg. for $\varepsilon = 0.5$) there are no parts of the graphics for which $f\left(x\right)\in\left(1,1-\varepsilon\right)$ (Figure 11).

However, since $f^{-1}\left(1-\varepsilon\right)=0.75$, if we choose $\delta = 1-0.75 = 0.25$ (or any other δ), than for $x\in\left(0.75,1.25\right)$ do not stand $\left(\forall x\in D_f\right)\left(f\left(x\right)\in\left(0.5,1.5\right)\right)$. That is because there are always some points right from 1 for which $f\left(x\right)>1.5\left(f\left(x\right)>\delta\right)$ ie. for which $\left|f\left(x\right)-1\right|<0.5$ do not stands.

Since it is enough to find at least one $\varepsilon > 0$ for which conditions from the definition of continuous functions are not fulfilled, we can conclude that observed function has a break at the point $x_0 = 1$.

IV. Conclusion

This paper describes an innovative way of enhancing the teaching and understanding of the concept of continuity using an open-source mathematical software package GeoGebra.

Proposed approach could be viewed both useful and feasible since this freely-available software provides a versatile tool for visualising mathematical ideas. Additionnaly, this method has great potential to be successfully used in the classroom environment primarily because it is easy to use, even for teachers of mathematics who are not proficient in using ICT.

Geogebra also entails students engaging with the potential that ICT brings, such as users learning from feedback, seeing patterns, making connections, working with dynamic images and permits activities that need high level thinking. [1]

The suitability and effectiveness of visual approach, as a learning tool, is reflected in the fact that visual explanations contributes to a clear and consistent understanding the concept of continuity of the function at the point from its domain and minimize difficulties connected with making sense of the symbols, quantifiers and inequalities. [6]

Finally, visual presentation may overcome the abstractness of the concept and the complexity of the formal way of concept presentation. [5] Thereby, new mathematical knowledge could be built simultaneously with developing creativity by advancing mathematical reasoning among the students. [8]

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METHODIC OF TEACHING INFORMATICS

D. Maravić, I. Ždrakanović, E. Eleven, I. Tasić
Technical Faculty "Mihajlo Pupin", Zrenjanin, University of Novi Sad, Republic of Serbia
david.serbia@gmail.com, isidorazdrakanovic992@gmail.com

Abstract: In this paper will be presented the term of Methodic of teaching Informatics, basic elements that are the subject of researching methodic of teaching Informatics. Also, there will be words about classification of teaching methods in teaching Informatics, as well as teaching forms such as frontal work, group work, individual work, and models of using computer in teaching. Although distance learning isn't a new concept in education, experience tells us that it is still unknown term. The intention is that this paper explain the basic characteristics of distance learning, its strengths and weaknesses, opportunities and usage. The development of information and communication technologies conducted a large impact on society, and therefore to education. Teachers needs for the realization of educational contents have changed. One of the ways to introduce interactivity in the classroom in order to further motivate students and to engage all their senses to acquire new knowledge is the use of interactive table. The paper describes the use of interactive table in the teaching process and the reasons for its application. The aim of this paper is to present that the development of information communication and teaching technologies offers many opportunities for improvement and innovation of teaching.

I. Introduction

Methodology of teaching Informatics is a pedagogical scientific discipline that deals with analysis and monitoring of development trends of IT education, establishing the principles, methods and techniques in teaching computer science as well as contemporary pedagogical processes such as learning, education and training. In the field of computer education, computer science methodology studies the particular phenomenon, its causes and consequences, determines the legality of these phenomena and points to the adverse and beneficial causes in order to achieve optimal results in IT education [1].

II. Methodic of Teaching Informatics

Tasks of methods of teaching informatics as a scientific discipline are

- Monitoring and analyzing the implementation of modern concepts of computer science and computers in teaching computer science with the aim of better training for teachers and students that are attending classes.
- Preparing and planning of the teaching content because of more efficient realization of teaching
- Developing methods and techniques in the field of IT education for better training of students for understanding and monitoring of the content.
- Application of other scientific disciplines and collaboration with other disciplines in order to efficiently develop curriculum in the formal and informal education.
- Training students how to implement theoretical knowledge gained during classes in solving some practice problems.
- Evaluation of the furthest results of teaching in the field of IT education.

The teaching system consists of three basic elements which are: teacher, student and teaching content. One of the supporting elements of the education system is a computer that controls the learning process by processing the teaching contents, monitor pupil's progress and evaluate the success of students. The whole system is supervised and monitored at three levels, namely:

- **Strategic management -** monitoring of the educational system of the country by the state, namely the compiling of education plan and program in science teaching.
- **Tactical management -** monitoring of teaching by supervisory departments that are responsible for the control of IT education with the goal of more efficient functioning of the school system and teaching process, control of teachers and their adherence to the curriculum
- **Operational management -** organization of classes by teachers so as to achieve maximum activity and motivation of students. The teacher has the task of leading the students from the beginning to the end of the teaching material for the purpose of understanding certain content and acquiring new knowledge.

A. Methods of teaching computer science

Lecture and oral presentation is a form where the teacher presents and explains the teaching material without the participation of students. The disadvantage of this method is that students may have uncertainties related to the subject matter and have no possibility of direct communication with educational content. They only acquire knowledge by listening to teachers.

Interview method is such a method where students can participate by asking questions related to the material during the lecturing of content by teachers. In this way teachers are developing the creative abilities of the students and the motivation for acquiring new knowledge and also contribute to the development of their mental abilities. This method requires good preparation of teachers for the execution of every stage of the teaching process.

Demonstration and illustration means the displaying of patterns, drawings, pictures, diagrams and charts related to the material, for example, on the projector for efficient mastering of the teaching content.

The method of working with text is a method where students acquire new knowledge by reading literature which they were given in advance such as textbooks, encyclopedias, handbooks, workbooks that use many sources of knowledge. The disadvantage of this method is that students may encounter difficulties, obstacles, problems in understanding the material but also allows students to develop independent thoughts and investigate that material themselves.

Method of written works represents self writing papers by students using a variety of sources and literature with the help and co-operation with the teacher. Teachers evaluate the quality and success of their work.

The method of problem solving and independent work is such a method where the teacher sets the problem related to the teaching material that students should self solve and present. Direct communication is represented between students and teaching content that a student is learning in resolving the issue. The teacher's role is small because the student independently and actively explores how to solve a problem that was given to him. The advantage of this method is that students become more motivated, creative and choose their own way in how to solve the problem. The knowledge gained in this way are more durable.

B. Forms of computer science teaching

The goal of teaching informatics is to increase the efficiency of the educational work, to develop mental abilities of students and to encourage students to participate in educational activities in order to achieve successful mastering of teaching topics and units. The most common forms of teaching are:

Frontal work is one of the most common forms of teaching. The teacher presents teaching material in front of the whole class. All students have the same tasks and objectives. Communication is possible between teachers and students but not between students. The disadvantage of this form of teaching is that students are placed in a passive position and it does not concern the different work tempo and progress of pupils, decreased activity of students and it neglect individual differences of students. The entire course content is directed toward the "average student".

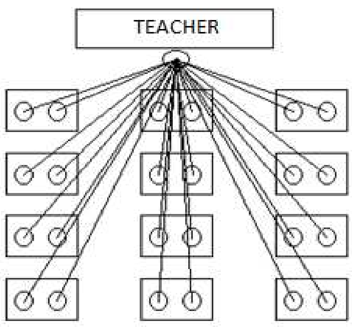

Figure 1. Frontal teaching form

Working in pairs is a form of teaching where two students are resolving the problem together specifying the problem with each other by exchanging opinions, pooling knowledge with the aim of finding the most efficient solutions for a given problem.

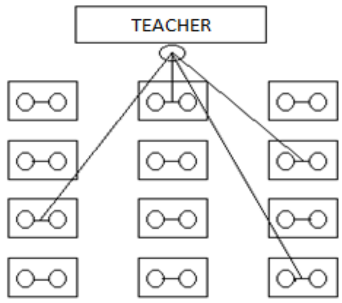

Figure 2. Working in pairs form of work

Group work is a form of teaching where larger groups of students are divided into small groups. In that way students learn and solve specific tasks. This establishes a competitive spirit in which the contestants are helping each other. They develop responsibility for their own success or the success of other group members. In this form of teaching teachers are developing the working abilities of students and teamwork that is already well developed in contemporary society and practice. The teacher's role is implied by the teacher facilitates selection of literature, preparation of teaching content, as well as help evaluate the quality of student work. There are two forms of group work: each group works on a specific topic and all of the groups are working on the same topic.

Individual work is a form of teaching where each student independently performs a specific task and has a direct relationship with the teaching content. This method of teaching is adapted to each student individually. It develops self-confidence and creative ability of students. The lack of individual work is the student inability to communicate with each other and to exchange ideas and information.

C. Models of using computers in education

The computer is a new powerful teaching tool that eases and improves a lot the teachers work. If there is a computer with accessories such as a video screen, interactive whiteboard, speakers and appropriate software it is possible to replace many other teaching tools. None of the educational system in the world can provide one teacher for every student but in modern society computers override that physical barrier. Accordingly, each individual student is progressing at the rate and in a manner fitting to his abilities. With the use of computers in teaching, lessons that are adapted to the needs and abilities of students become more interesting which is increasing the motivation of students, encourages active learning and increases the amount of information the student remember during class, which are able to reproduce later. Traditional teaching has its disadvantages which can be avoided by using a computer:

- The student becomes the subject of teaching. He is no longer a passive recipient of information. Instead, he learns actively.
- The student receives feedback about what is wrong in his answer and what is true. It is a good principle of self-inspection.

Computer programs, which are used in teaching may be divided in to:

- Programs for learning - they provide new information
- Programs for training - they form the abilities and habits of students. These programs provide information about the outcome of the work of students and constantly inform them which achieves consolidation of good answers. They assess the success of students.
- Programs for solving problems (detection programs) - the student works independently those tasks that the computer sets him.

D. Distance learning as a modern form of teaching

Distance learning is a good form of improving teaching and the process of education itself. Computers allow us more personalized approach to each student which includes interactivity of students as well as his work at their own pace. One of the biggest advantages of distance learning is the opportunity to attend school and courses that would not be possible without this learning technology which implies a reduction of spatial and temporal constraints. Students can learn from home and actually attend school in another town. In addition to gain information about what they are learning, students also learn about different technologies and they adopt additional applicable knowledge and skills. By having the students themselves determine the pace, time and way to learn, we are changing the habits in students and teachers. Distance learning as a special teaching method has its drawbacks. The isolation of students from other students is a problem because there are no social contacts between them which can lead to giving up because students feel lonely on course they take. There are also problems of a technical nature, because not all students have the same possibilities to provide the necessary equipment itself as well as to master the technology that is needed to be able to successfully attend a particular course or school by this method of learning. This type of learning requires great motivation of students in order to regularly fulfill the obligations that student has. As students have its problems, so teachers also must devote a lot of time to the preparation of teaching content in order to adapt it to this type of learning.

There are two subtypes, i.e. modalities of distance learning:

- **Synchronous** where teaching takes place in real time (videoconferences, chat)
- **Asynchronous** where teaching does not require the simultaneous participation of students and teachers. This means that students themselves choose what time they want to adopt a particular subject area.

E. The use of interactive whiteboards in the teaching process

Electronic interactive whiteboard is a new teaching tool that gives students and teachers a completely new experience in learning, as well as convergence and bridging the gap between the virtual and the physical world. With the electronic multimedia panel, we have a huge amount of learning material that is always available: text, graphs, charts, films or animations that are required to work in class. These boards have the ability to record changes or to record the entire lectures, which later provide easier repetition for students. Each object (line, solid body, complex illustrations) can be freely manipulated. Its characteristics allows the display of a large number of educational software, editing documents at-site, by using various software applications. The emphasis is placed at student activity rather than the recording of information.

Benefits of using interactive whiteboards are: greater student motivation, interactivity with teaching materials and greater participation of students in the learning process. Using interactive whiteboards, students and teachers develop their digital skills while at the same time it is provided a greater variety of content and teaching methods, and therefore a greater ability to adapt to different learning styles of students. Mastering and understanding of complicated tasks is a lot easier thanks to clearer, more dynamic and effective presentations. Therefore, teachers need to master the art of using the interactive whiteboard. They have to watch for new technologies and constantly improve their knowledge so as not to come into a situation that a new generation of students know more about specific technologies in computer science than them. The quality and value of teaching depends also of on how much the teacher knows about taking advantage of the opportunities that modern technology provides. There are several manufacturers of these free interactive whiteboards, which provide a large number of online lessons and tutorials on using these modern learning resources.

Figure 3. Interactive whiteboard

III. CONCLUSION

In this modern information the need for modern school and modern school teachers is increasing. The problem is the lack of willingness of schools to adopt new technology and incorporate information technology as a tool in teaching all subjects. Most psychologists claims that despite significant results in science teaching, there are still serious shortcomings in the teaching process. The first such drawback is the lack of activity of children in the learning process, as well as the loss of independence of pupils. The acquisition of knowledge is commonly the reproduction, the student reproduce knowledge that his teacher transfers to him. This takes a lot of time and repetition of material. However, if the student is not passive, but actively participate during lectures, learning will be much more efficient. That is brought by interactive table as one of its greatest benefits. Another disadvantage is that the student does not receive feedback about the results of their work and activities. School marks serve just for information purposes.

Students often do not receive ratings based on learning, and student cannot determine exactly what is good and what is bad in their answer. Tests prove that learning is much more efficient if the student is informed about the results of learning so they know exactly which part is done correctly and which is not. In this way, mastering of the material can be done through trial. The complexity of the teaching process becomes greater by developing of information and communication technologies, but at the same time it offers countless opportunities for improvement and innovation in teaching. Students today live surrounded by information technologies that can elevate individualization principle to a new level. With the application of information technology, teachers could further activate and motivate the students outside of school which should be a recommendation for the road in which the teaching process should be developed.

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LIFELONG LEARNING AND TEACHERS' PROFESSIONAL TRAINING

EVALUATION OF WEB-BASED RESOURCE FOR CAREER EDUCATION IN TECHNOLOGICAL TRAINING

E. Tosheva
Faculty of Pedagogy, SWU "Neofit Rilski", Blagoevgrad, Republic of Bulgaria
emilia_tosheva@abv.bg

Abstract –The present article covers the process of implementing the ADDIE model to design a web-based resource for career education in technology education. It also provides the stages of the design process, clarifies the content, and discusses the pedagogical and technological requirements for the creation of the resource.

The web-based resource is a way to integrate the curriculum of career education technology training by the use of modern web technologies.The created web-based resource may be used except in the hours of technology training and in outside classroom desks forms of training.

Web-based resource for career educationin technologicallearning is a complex subject that includes content, which is related to career education and applied technology courses in using the capabilities of web technologies.

The web-based resource for career education has been developed by the model design training–ADDIE(Analysis-Design-Development-Implementation-Evaluation), which includes phases: needs analysis; design; development; implementation and evaluation at every stage of the design process.

I. DESIGN

The first stage - needs analysis include: description and objectives of the resource; who are trained?; what characteristics?; form of education; any obstacles; Measurement - how will we know that learners have achieved the objectives; online pedagogical considerations; timeframe and rhythm.

The second stage - design and specifying:

What are the objectives?; Measurable Are?; What skills / knowledge will develop?; What should be the interaction?; What strategies will be used?; In what order will be implemented learning process?; How will it assess the level of perception of the trainees?; What network environment applicable?.

Third stage - development of web-based resource for career development in technological training. During this phase specifying: What resources will be used?; How will it manage the process of development and how it will coordinate?; Does the project different learning styles?; Introduction of the material in a variety of formats to enable a learner to make choices.

Fourth-stage implementation of a web-based resource for career education in technological training. During this phase the plan is drawn up which establishes the sequence of deployment and training procedures trainers and trainees, as well as completion of the final product, web-based resource. The final product is further developed based on the needs and the errors found during the use of a prototype of the product by some of the student target group. All necessary tools for training are checked whether they are ready and available.

Fifth-stage evaluation of a web-based resource for career education in technological learning includes: assessment of pedagogical usability of the resource and its technological usability.Usability is a way of learning, in which the starting point are users The concept is used as a characteristic of different products - websites, software, electronic teaching materials, etc .. According to the international standard ISO 9241-11 usability is the "extent (of convenience), with which the product can be used by specified users to achieve certain objectives with the necessary efficiency, productivity and satisfaction in conditions (context) [1].

II. USABILITY

Technical usability of web-based learning resources associated with their technical dimensions. Nielsen defines usability as the ability of the system to provide functionality that correspond to user needs and how well users can use these features that the system offers [3].

Technical usability criteria are: visibility, aesthetics and minimalism, familiarity, a sense of control, uniformity and standartnost, readability, flexibility and simplicity, content, readability, prevent errors, error recovery, images, links, forms.

These criteria can be summarized in two criteria:

- **graphic designs;**
- **designs of content**.

Usability pedagogical concept of digital education content introduced by Nokelainen. In his pedagogical usability includes 10 components: control of the learner, learner activities, cooperative learning, learning objectives, relevance, value added, motivation, evaluation of prior knowledge, flexibility, feedback[4].These criteria are complemented pedagogical usability in terms of web-based learning resources [2].

- Criteria for pedagogical usability:

1. **Understandable -** provides a structured description of the course content, contains clear definitions and explanations.
2. **Students control -** describes the student's ability to control the order which performs the activities.
3. **Defined learning objectives**
4. **Time -** provides the learner limited but enough time to absorb the material.
5. **Interactivity -** provides an opportunity for interaction through easy and user friendly access to educational content and tasks that the user has to decide.
6. **Multimedia -** web-based learning resources should provide multiple presentation of information using various multimedia elements such as text, graphics, images and sounds.
7. **Motivation -** materials contain motivating tasks and examples. Below are the important aspects of the subject area, which can affect learning.
8. **Differentiation -** compliance with the age of the students, their interests, language, motivation, etc.
9. **Flexibility -** provide different levels of difficulty.
10. **Autonomy -** provides an opportunity for self-absorption of educational content without the teachers intervention.
11. **Joint activities -** an opportunity for collaboration with other learners during Utilization of educational content.
12. **Variability -** the ability of using different learning resources.

III. Evaluation Of Web-Based Resourcefor Career Education In Technological Learning

The site "Career education and echnological learning"is designed according to established design a web-based resource for career education in technological learning.

The site ", which is located on the Internet at:https://sites.google.com/site/uebbaziranokovto/is evaluated by students, teachers and university students and shows that importancein the development of such resources is the technical usability, as well as their pedagogical usability[5].

-*Correlation analysis (Table1.)*

Between pedagogical and technical usability shows that all variables of pedagogical usability are positively connected to these in technical usability.The correlation coefficient τ of Kendall defines the connection between two variables in our case between the criteria for technical and pedagogical usability. One possible explanation of these positive correlations is that the technical usability has a positive impact on pedagogical usability. The analysis of the responses of students and teachers showed that their perceptions of technical and pedagogical usability are very similar, all three groups believe that the site "Technological training and career education" are technically well conceived, understandable, interactive, flexible and variation.

This does not necessarily mean that there is a causal relationship between them. Although it is reasonable to believe that the criteria for technical usability affect your criteria for pedagogical usability, the strongest relationship is between graphic design and interactivity (0.384 **) and design of the content and time (0.410 **) and the lowest between graphic design and flexibility (0151 **) and the design of content and flexibility (0,044 **).

TABLE1.CORRELATIONS BETWEEN TECHNICAL AND PEDAGOGICAL USABILITY

	GRAPHIC DESIGN	*CONTENT DESIGN*
Understandability	,345**	,391**
Added value	,367**	,396**
Goal-orientation	,345**	,391**
Time	,356**	,363**
Activity	,334**	,384**
Multimedia	,527**	,329**
Motivation	,309**	,330**
Differentiation	,393**	,442**
Flexibility	,384**	,281**
Autonomy	,398**	,394**
Collaboration	,345**	,391**
Variation	,267**	,296**

IV. CONCLUSION

Evaluation of web-based resource for career education in technological training is an important phase of the design of web-based learning resources that guides teachers in their development, allowing them to make the necessary adjustments to achieve high efficiency and quality.

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APPROACH TO TIME ORGANIZATION FOR TEACHERS

V. Brtka, E. Brtka
University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
vbrtka@tfzr.uns.ac.rs, norab@tfzr.uns.ac.rs

Abstract - The paper deals with approach to time organization for teachers. Teaching is different compared to other jobs because much of the day is scheduled for the teacher. Proposed approach is based on calendar in pen-and-paper form or in the electronic form like Google Calendar. In addition, the options and possibilities for sharing calendar with students are discussed and elaborated. In addition, guidelines to create a good calendar are given.

I. INTRODUCTION

Recently there is a substantial growth in technology usage in schools, although the use of new technologies is not as big as it is in some other domains like science and research, industry, marketing or economy. Just a few decades ago, teachers could expect that what they taught would last for a lifetime, the syllabus was fixed and the content was at the center of education. Now, there are changes in the demand for skills for teachers with profound implications for the competencies which teachers themselves need to acquire [1]. Teachers need to enable students to become lifelong learners and to manage non-rule-based complex ways of thinking. In the past, teaching process was curriculum centered, while in the present teaching process is learner centered, so that teachers have to identify how individuals learn differently and allow individuals to learn in the ways that are most conducive to their progress.

This new kind of education requires teachers to be high-level knowledge workers who are able to advance constantly their own professional knowledge, so that teachers need to improve both, efficiency and productivity. However, teaching can be overwhelming: teachers have lessons to plan, meetings to attend, reports to write, emails to respond to, and, most importantly lessons to teach, but there is a limited amount of time. According to [2]: "Time management for teachers is far more complicated than for office workers or in other industries." As in [2]: some challenging tasks for teachers are:

- Much of the day is scheduled.
- Teacher has to be available for students and parents beyond classroom teaching time.
- There are demands from administration.
- Good teaching requires high levels of both energy and skill.

The research presented in this paper deals with problems related to time consumption tasks in the domain of education. The main goal is to increase both efficiency and productivity of the teacher by time organization. This involves the use of advanced information technology, although it is not mandatory.

This paper is organized as follows: In section II, some relevant previous research results are given. Section III is essential because it deals with time management accessories, solutions and ideas for teachers. Last section contains some conclusions, recommendations and directions to future work.

II. BACKROUND RESEARCH

Time distribution is coupled with the organization of the school and the organization of the teaching process and lessons themselves. This becomes obvious when some kind of information technology is applied, and this is the actual case nowadays. There is the possibility of dynamic, multidirectional associations between organizational resources, human resources, technology and students. The relation between teaching and organization depends on what conception of teaching prevails [3]. The importance of particular resources may also vary among and within educational systems. According to [4]: "The work environment in which teachers operate is key to their ability to exercise their professional roles effectively...". The profile of individual school depends on:

- Size of school.
- Level of education.
- School location (urban or rural).
- Multi-level classrooms and double shifts.
- etc.

Positive work environment for teacher depends greatly on hours of work and workload. This becomes apparent in schools with many students and double shifts. However, this is not new: according to ILO/UNESCO Recommendation's call to maximize the time and energy of teachers as skilled professionals (1966: paragraph 85, Appendix 1) policy-makers, should establish a working environment that is most motivating for individual teachers and there are three goals:

- Produce the highest levels of professional teaching and job satisfaction.
- Focus on core teaching and learning responsibilities.
- Maximize teacher productivity measured by learning achievements or outcomes.

It is essential to time-organize and rethink the time consumption and time distribution for each individual teacher in order to achieve these goals. Therefore, hours of work and workload are crucial to achieve the work-life balance in education. The ILO/UNESCO Recommendation (1966: paragraphs 89–93, Appendix 1) [4] contains the factors to be used in calculating teachers' hours of work: number of lessons (classes) and pupils (students), lesson preparation time, student assessment time (homework, tests and other forms of assessments), collaborative teaching opportunities, research, student meetings, supervisory duties, extra-curricula activities, parent meetings, administrative responsibilities, professional development time, maximum hours of work. Fig. 1 shows the number of teaching hours per year in lower secondary education in 2000, 2005 and 2009 for public schools (http://dx.doi.org/10.1787/888932462035).

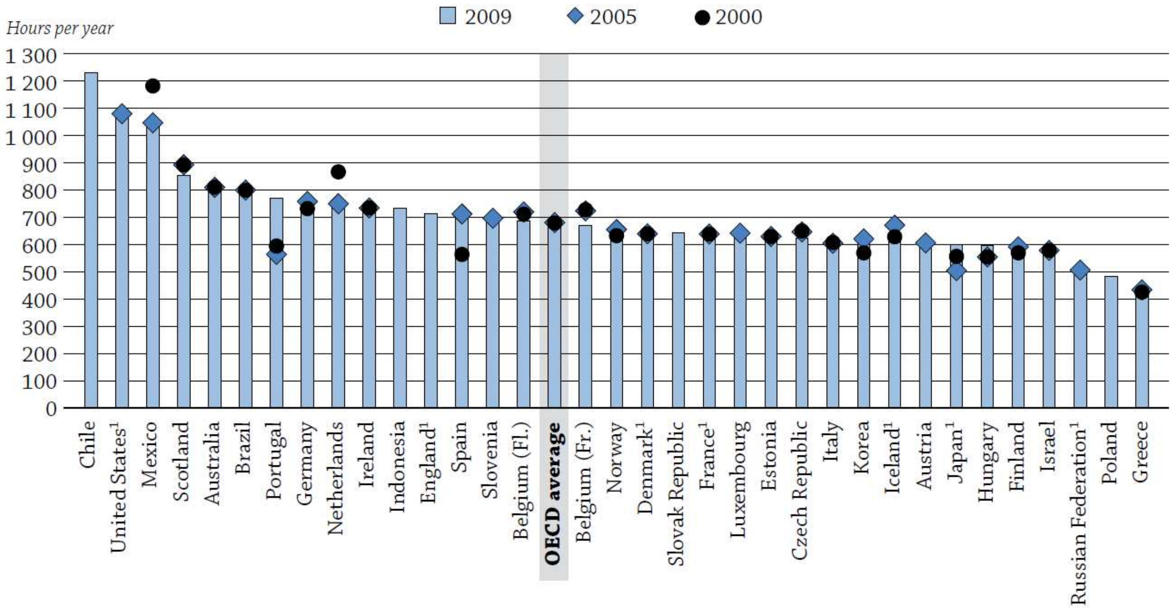

Figure 1. Number of teaching hours per year in lower secondary education in 2000, 2005 and 2009

It is evident that there is no big change between 2000 and 2009. According to [5]: "It also seemed clear that antiquated educational and managerial dictums implicitly prompted many, if not most of the problems that they encountered". Nevertheless, teaching and education are future-oriented, so it is the imperative that researchers, teachers and administrators understand the importance of technology in the domain of education. One possible way to bring in technology is to apply software accessories for time organization, management and planning. That can be a key to maximize teacher productivity.

III. Time Management Accessories

Therefore, main question is how to be well time-organized? In order to give an answer to this question, it is necessary to determine what is different in teaching compared to other jobs. This was done in previous section, but arguably, main difference is that much of the day is scheduled. Ideally, about 50% of working time is instructing students, while about 50% of working time is analysis and planning, but it is not unusual that instruction part takes about 80% of a working time. Every teacher has to find the time for review, analyses, meetings, etc. According to Maia Heyck-Merlin, who is the author of the course "Get Organized: How to be a Together Teacher" on Relay Graduate School of Education, USA (available on Coursera web site), calendar is flexible way to organize time on day-to-day basis or weekly. However, if you are a teacher then there is less flexibility. Even 20, 15 or 5 minutes are very precious sometimes. Therefore, teacher has to "squeeze" many tasks in short period of time. What a teacher need is a portable organization system; it would likely have a pen-and-paper element but technology usage is also possible: a tablet or a smart phone. System may be incomplete and somebody may use it sometimes but there has to be some system. As presented in above-mentioned course materials, there are four types of persons from organizational point of view:

1. The seeker, many tasks going on in the same time, hard to chose which one to complete.

2. The consolidator has multiple lists, both for private and professional part of life, but separate lists are often hard to follow and the lists are not in one place.

3. The planer plans for tomorrow and maybe for a few days ahead, but this is not enough.

4. The prioritizer chooses the easy stuff to do if there is not much time. The complexity of a task depends on the amount of the time that is available. Most important work is handled first.

Obviously, the seeker is a "messy" person, while the pripritizer is "organized" to some extent, but all of them need some kind of organization. It could be hard-copy paper sheet whit actual calendar with boxes and to-do lists (to-dos) or an electronic calendar. According to Maia Heyck-Merlin a calendar is a good way to organize time: everything is centralized in a single location.

Further issue of importance is whether the teacher should share the calendar with the students and if so, to what extent? There are teachers who use social networks as a tool for establishing and maintaining contact with their students, and they do so in a variety of ways and for a variety of purposes [6]. The purpose of this interaction is very often academic-instructional (other two are social and psycho-pedagogical). The goal of academic-instructional between teacher and learner are:

1. Expanding learning beyond the classroom.

2. Managing and organizing school-related activities.

Therefore, those are good reasons for teacher to share the calendar with students. However, there are some dilemmas and conflicts about the potential blurring of different types of boundaries: privacy vs. intimacy, authority vs. friendship, and availability vs. responsibility. The main reason for using social networks for these purposes is that it expands the scope of instructional opportunities [6]. This is a good way to save time because it is possible to distribute and share learning materials, orchestrate at-home study during after school hours, establish private communication channels for one-on-one tutoring and so on.

Another research of this kind was conducted in [7]. Teachers' practice with social networks or blogs and sharing information with students do not seem to contribute substantively to their technological pedagogical content knowledge. When teachers use these electronic tools in teaching, they seem to pay more attention to aligning the tools with content goals and selected pedagogy.

Usually, it is recommended that teacher should share only contents that will have positive impact on time consumption and time distribution via some kind of electronic calendar.

There are two basic ways to implement time sheet or calendar: pen and-paper or electronic means of any kind. It seems that calendar type time sheets are good way to organize time for teachers.

Fortunately, according to previous investigations there are some guidelines on how to put together a good calendar. Most important task that teacher should do while preparing the calendar is to plan in advance (for next week in a small steps) or weekly. Another important thing is to keep most important tasks in a center of a calendar or in a focus.

Detailed properties of a good calendar are:

1 It must cover an entire week (Monday to Friday, or all seven week days).

2. Teacher has to be available for students and parents beyond classroom teaching time, so it is good to plan a time for this.

3. It has to show the time and to-dos even free time and busy time. Free time is not obvious; it is good to plan free times.

4. Plan in advance.

5. There are demands from administration, so teacher must have in mind this and include some additional tasks in his/her calendar.

6. Portability and accessibility are very important.

7. The calendar must be consistently used.

These seven items are very good guidelines to prepare and put together a calendar. However, it is possible that there are more items in some special case.

IV. CONCLUSION

This paper deals with approach to time organization for teachers. In first and second section, it is underlined that time organization is very important for teacher. The main difference between teaching and some other job is that much of the day is scheduled for teacher. Breaking things down to small pieces is very important because there is short time intervals between classes in which teacher can perform certain tasks. There are time-oriented planners and task-oriented planners, but both need a time sheet. It is concluded that calendar is a good form to put together a time plan. Third section of this paper gives seven detailed properties of a good calendar. This calendar should be portable and accessible, comprehensive and grouped (by week or by month). It could be hard-copy paper sheet with actual calendar with boxes or electronic variant of a calendar like Google Calendar.

All activities, professional or private should be included. In addition, the calendar should include to-dos: small actions that are not much time consuming so they can be performed in a specific time interval. The deadlines and important tasks are at the top of the calendar, while small and simple tasks are put in Friday because teacher is probably tired. There are some block times every day for repeating activities.

There are also hard to-dos with deadlines and soft to-dos without hard deadline. This enables strategic procrastination of some tasks.

Finally, there is a question: what to use pen-and-paper calendar or electronic calendar? Even today, most teachers are using pen-and-paper calendar, but there are certain benefits if a teacher uses electronic calendar like Google Calendar. Electronic calendar is always accessible through phone or computer; it is accessible at any time. There is always backup on some "cloud" system like Sky Drive or Google Drive. Certain parts of an electronic calendar could be shared with students so that they are informed automatically in the case when there are some changes. Lastly, electronic calendar can be printed and used in pen-and-paper form.

The future work will include the research of benefits and limitations of Google Calendar, as well as the implementation of specific calendar for teachers. The future research will include the development of software tool for business process planning.

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EXPLORING TEACHERS'S PROFESSIONAL DEVELOPMENTIN THE USE IF TECHNOLOGY IN EDUCATION

J. Jezdimirović, S. Radović
Faculty of Mathematics, University of Belgrade, Serbia
jezdimirovic.jovana@gmail.com, radovic.slavisa@gmail.com

Abstract - The aim of this paper is to answer the relevant questions related to the success of the provided teachers training in the use of information and communication technologies in the educational process. Qualitative and quantitative researches are performed in order to investigate whether mathematics teachers use available educational software and electronic materials for everyday educational purposes. Examination shows the relationships between years of teachers' experience, gender, competence in the use of ICT (information and communication technologies) and their attitudes related to the usefulness of the provided training as well as the efficiency of ICT integration in traditional instruction.

I. INTRODUCTION

During the last three decades, the educational environment has been changed drastically [1]. Learning process around the world is experiencing major paradigm shifts in educational practices of teaching and learning under the influence of ICT enhanced learning environment [2]. The major goal of that learning paradigm is transition from teacher centered to learner centered focus [3] [4]. Education process changes, from traditional model to knowledge in the focus model and influence of technology rapidly changes teaching aids from chalk and talk to PC and Internet [5]. The wide models on changes in teaching and learning environment have been described in a Table 1.

TABLE 1. CHANGES IN TEACHING-LEARNING ENVIRONMENT

Model	**Focus**	**Role of Learner**	**Technology**
Traditional	Teacher	Passive	Chalk and Talk
Information	Learners	Active	Computers
Knowledge	Group	Adaptive	Modern devices and internet

It has been argued that ICT are effective teaching tools that allow the control, regulation, management of teaching and learning through continuous feedback, learning evaluation system or menagment sistem. Different types of educational software, from computer-assisted learning, intelligent tutoring systems, to open learning environments have been used to reduce classroom deficiencies during learning [6]. Education softvare enable a completely different organization of teaching and educational work, adapt abilities and interests of each student, and provide more efficient transmission and absorption of knowledge [7].

This new environment also involves a change in roles of both teachers and learners. The role of the teachers will change from knowledge transmitter to that of facilitator, knowledge navigator and sometime as co-learner. The new role of teachers demands a new way of thinking and understanding of the new vision of learning process. Learners will have more responsibilities of their own learning as they seek out, find, synthesize, and share their knowledge with others. The major shifts in teacher role have been described in a Table 2.

TABLE 2. CHANGES IN TEACHER'S ROLES

From	**To**
Transmitter of Knowledge	Guide & Facilitator of Knowledge
Controller of Learning	Creator of Learning Environment
Always Expert	Collaborator & Co-learner
Learn to use ICT	Using ICT to Enhance Learning
Didactive/ Expository	Interactive/Experiential/Exploratory

II. FACTORS INFLUENCING MODERN TEACHING TECHNOLOGY ADOPTION

Modern educational technology improves and changes the teaching process and the teacher as the creator of teaching process should use all of competencies to successfully transfer knowledge and make learning possible [2]. The teacher professional development in the use of interactive technology should embody and model the forms of pedagogy that should be used in the classroom.

However, many studies have been conducted to investigate barriers to the integration of technology in education [8][9][10]. Ten Brummelhuis [11] in his research literature on the implementation of ICT, shows that it involves a large number of influencing factors. Several studies have produced an extensive overview of influencing factors and conditions for the implementation of ICT [12]. Drent and Meelissen [4] made distinction between non-manipulative and manipulative school and teacher factors:

(1) Non-manipulative factors are factors that cannot be influenced directly, like age, teaching experience, (educational) computer experience of the teacher or governmental policy and the availability of external support for schools.

(2) Manipulative factors are attitudes of teachers towards teaching and ICT, ICT knowledge and skills of teachers, commitment of the school towards the implementation process and availability of ICT support.

Similarly, Balanskat et al. [13] divided factors which can influence ICT integration into micro level barriers, including those related to teachers' attitudes and approach to ICT, and meso level barriers, including those related to the institutional context.

In their study, Drent and Meelissen [4] stated that the success of the implementation of ICT is not dependent of the availability or absence of one individual factor, but is determined in a dynamic process. That process of adoption and implementation of ICT should involve a set of interrelated factors [11].

III. Teacher Professional Development in the Use of Technology

The propriate use of ICT in classroom is of crucial importance in order to maintain efective learning enviorment [2]. Spending high amount of resources on informational technology hardware and software without financing teacher professional development will not initiate the expected changes. The researchers argue that teacher professional development is absolutely essential if technology provided to schools is to be used effectively. Experiences around the world in developing and information-based countries have shown that teacher training in the use and application of technology is the key determining factor for improved student performance [7]. Thus, professional development is necessary to enable them to effectively use technology to improve student learning. Teacher preparation for effectively technology usage in their teaching is esential for creating positive and motivational learning enviorment. Pelgrum et al. [1] In this research has shown that teachers who have a strong engagement towards their own professional development are more motivated to undertake activities, which lead to a better understanding of the goals of an innovation.

In line with this idea, Fullan [14] pointed out that teachers who are actively involved in their own professional development are more able to implement changes in their teaching. Nevertheleess, it should not be omitted neither good technical equipment of both students and teachers as well as the educational environments in which classes will be conducted. Hence, innovative and effective ICT integration in schools will motivate teachers to use ICT in teaching. These factors must be available in order to create changes in the classroom.

From the above, it is nessesery to point out that the technology enhanced education requires that teachers, managers and administrators in public schools and colleges have the knowledge, skills and support necessary to integrate ICT into teaching and learning. ICT has brought new possibilities into the education sector, but at the same time, has placed more demands on the skills' level of teachers. Nevetheless, ICT integration into curriculum delivery is not simply about acquiring ICT competency. It is about the "appropriate selection, use, mix, fusion and integration of many sets of competencies including, but not exclusively, those in pedagogy and technology" (Information and Communication Technology in Education, UNESCO; 2003:18).

It is clear that models, levels, methodologies and success of ICT use in teaching worldwide are different, even within the educational system of one country, and even between different teachers within the same school [15][16]. On that basis, it is necessary to set up a guidance framework for e-learning to make that practice possible.

IV. Problems That Teachers Facing in Serbia

In the past few decades Serbian education system is undergoing changes at all levels; the key policy issues is related to the change of dominant modes of teaching practice. Previous attempts to change traditional education practices were not based on sufficient research findings. In this process the education system will need to get restructured, new roles and responsibilities to set, new institutions to develope, new functions to built. Moreover, it is necessary to adopt strategies for education improvment which define the crucial directions of development in this area, and have defined standards of learning through government decisions.

The Government of the Republic of Serbia and the Ministry of Education and Science, bringing act: Education Development Strategy in Serbia until 2020, which should fulfill two primary roles [17]:

(1) integrated framework (base) for the design of key legislation, by-laws and other regulatory institutions and instruments functioning and development of education in Serbia.

(2) main strategic instrument by which the system of education in Serbia translates from the present to the desired and attainable state of 2020+ years.

Education Development Strategy in Serbia until 2020, recognizes and the emphase the importance of the role of ICT for improving the education system [17]. But due to the complexity of the issues for successful technology integration into the education system, as well as the lack of documents that would assist in the formulation of educational policy in this area, the National Education Council (NEC) has initiated the drafting of the guidelines for promoting the role of information and communication technologies (ICT) in education.

Improving the quality of teaching and learning, as well as the integration of ICT into the education system, depends on curriculum development, teacher practice evolution and purposefully-designed educational software and ICT infrastructure [18][19]. National documents in Serbia emphasise the need for making the conditions appropriate in order for ICT to become an integral part of teaching practices in all subjects [17]. In the planned measures, there has been included the statement “to train all teachers to use ICT in teaching or its preparation” (p.30).

Ministry of Scince, Education and Technology and the Ministry of Tourism, Trade and Telecommunications, throw many official documents, project and iniciatives encourage and facilitate the uses of ICT and innovative methods in teaching. Teachers are encouraged and motivated to use computers in all forms and types of learning activities, but there is a lack of knowledge about adequate methods, materials and teaching practices. In a survey conducted about the use of ICT in schools in Serbia, Džigurski [20] emphasised that the basic motives for teachers are - raising the quality of teaching, and encouraging pupils’ motivations for the subject, as well as the improvement of pupils’ concentration and attention in class.

Due to the lack of teaching materials and interactive learning resources, teachers have a problem in organizing such kind of teaching. Teachers themselves already by now develop materials in electronic form and make them available on the internet, usually in the form of blogs [21].

Radovic and Passey [22] in their analysis of comparing developments in formal-informal education practice in Serbia and the UK emphasize that over the past few years, through many projects, efforts have been made in order to modernise schools and information systems in Serbia: "In the framework of the MoEaS project “Modernization of the vocational school system in Serbia” (2002) modern information technology (IT) equipment worth 1.5 million Euros was purchased during 2011. Secondary schools (87 of them) have obtained a fully equipped computer room or a classroom for vocational courses where lectures can be implemented using educational software. The MoTTT implemented, through the framework of the project “Digital School”, fully-equipped computer classrooms in 2,808 elementary schools in Serbia during 2010. In that way, basic infrastructural conditions have been acquired for using ICT in teaching".

Although IT hardware are present and available in all schools, the level of equipment and usability are far from perfect. Important problems are related to the possibilities for the use of existing equipment and availability for use in the teaching of all subjects. They are just one of the preconditions for ICT usage in teaching. Passey [23] in research state that to foster the learning potentials with ICT, teachers in primary and secondary schools need support in the following areas: developing appropriate teaching strategies, using appropriate available resources and creating interactive resources.

In different study of computer use in schools in Serbia, emphasizes that: There is no clear strategic approach to promoting the role of ICT in teaching at both the school and the local community, as well as at the level of ministries and institutions responsible for the regulation and development of the area [20]. Developing the role of ICT is therefore primarily based on the enthusiasm of individuals. Lack of organized support for the implementation of ICT in educational institutions implicate poor organized acquisition and maintenance of technology and the inadequate organization of training for the development of teacher competencies. This is most clearly reflected in the wide spectrum of arbitrary measures and various initiatives which schools are trying to meet in order to challenges the process of introducing modern teaching methods and technologies in classroom [20][22].

V. RESEARCH

In order to investigate factors which can influence ICT integration according to [4][13] in Serbian educational system, research has been conducted. The main goals of the examination have been to explore and identify all the factors which may help to all involved in education process as well as to provide professional help to teachers in usage of ICT, particulary software GeoGebra in math classes.

Serbian educational institutions supported the research activities and teacher’s training. Furthermore, they have made it more attractive and available to teachers in primary and secondary schools in a way of providing them technical equipment, materials and all the informations during their ICT professional development. As in Figure 1 has been shown, schools, both primary and secondary had the key role in gaving information to the teachers of professional ICT training, according to a fact that majority of examined and trained teachers (29) have been informed by schools about this professional development.

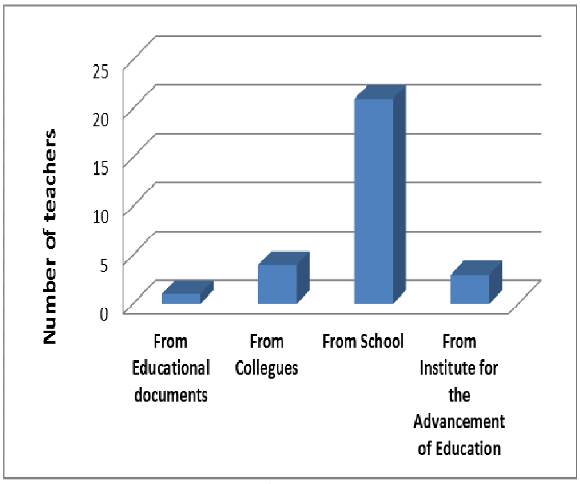

Figure 1. Getting information on ICT training

Since there is a still a lack of appropriate e-materials in Serbian language and the fact that the level of equipment and its usability are far from perfect in Serbian schools, the main aims of the teacher training have been to support teachers in ICT integration in a way of providing ICT instruction, to identify main difficulties that teachers are faced with in ICT integration and to distinguish which teacher’s individual caracteristics and attitudes have the most influence on active use of ICT in education.

The first group of trained and examined teachers has been heterogeneous group from primary and secondary schools with different numbers of years of experience. Figure 2 explains the correlation between numbers of teacher’s experience and their commitment in profesional development in a way of participating in workshops and other profeesional developing activities, particulary in the provided ICT training.

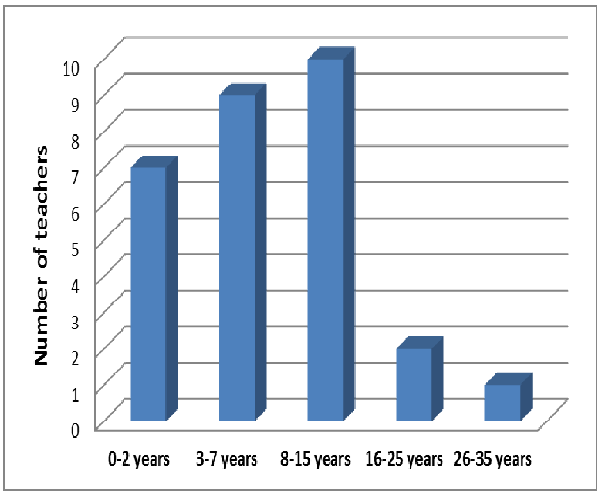

Figure 2. Number of teacher’s years of experience

Provided ICT instruction has included practise with computers and math software GeoGebra as well as workshops in order to provoke teacher's curiosity for e-teaching aids and creating their own interactive mathematics lessons. Professional as well as technical and pedagogical assistance have been provided to participants face-to-face and via e-mail. Qualitative and quantitative researches are performed via interviews and a questionnaire modeled after the semidirect Likert scale assessment in order to investigate whether mathematics teachers use available educational software and electronic materials for everyday educational purposes and their attitudes related to ICT integration.

VI. RESULTS

Examination results show that there is a correlation between number of years of teachers experience and their motivation for active involment in further profesional development, as described in Figure 2, where only 3 teachers of 29 examined and trained have more then 16 years of experience. On the other hand, differences in number of female and male respondents, described in Figure 3, could be explained by generally smaller number of male mathematics educators in Serbia, although male 's average grade of usfulnes of ICT training is higher (3,95 of 4) then female's.

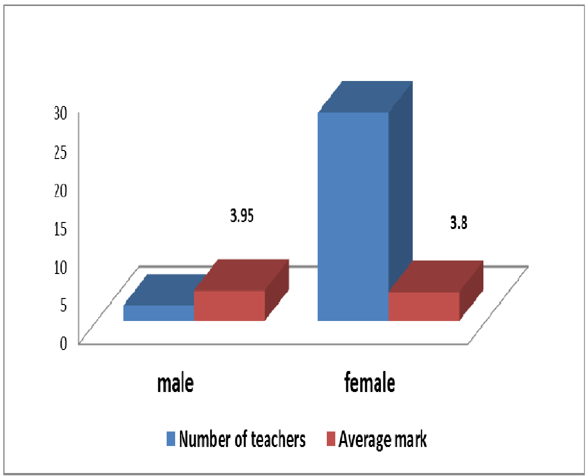

Figure 3. Gender differences

Differences between primary and secondary school teachers in their motivation for modernizing traditional instruction are given in Figure 4 which shows dramaticlly high number of primary school teachers in comparing with secondary school teachers that have been trained for innovative math classes and usage of variety of e-learning materials and software as GeoGebra.

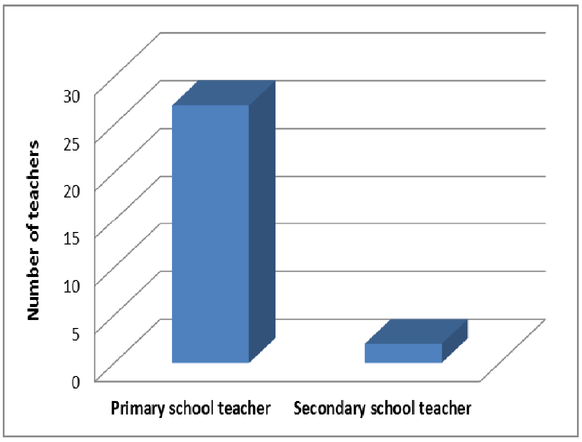

Figure 4. Number of primary and secondary school teachers that have been trained

Since one of the goals of the research activities have been providing suport for teachers in ICT practice, after the one day instruction, respondents have been asked about it's usefulness. Using a questionnaire modeled after the semidirect Likert scale assessment respondents answered, among all, about their opinion, respectivly:

1. If the defined training objectives are achieved
2. If methods, techniques and approaches applied in the training provided participants learning
3. If attending this training will help them to improve their work
4. If working conditions have enabled the successful implementation of training
5. To give an average mark of provided profesional ICT training

The answers are given in Figure 5:

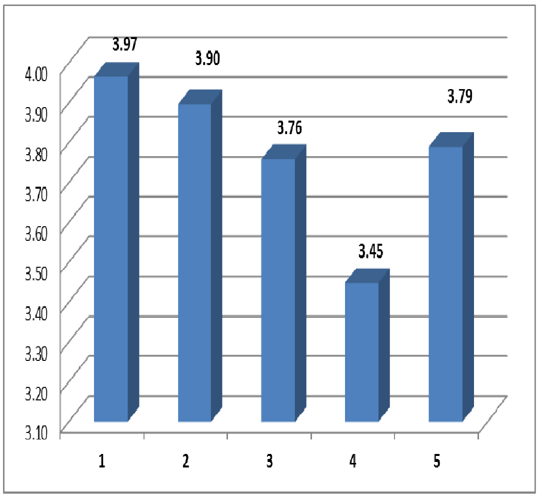

Figure 5. Average marks on performed activities

It is remarkable that participants have marked the highest achieved defined training objectives, despite working conditions. On the other hand, respondents have marked all questions by average mark 3,79 of 4 which is a strong evidence of highly sucessful training.

Interviews with respondents have revealed their attitudes towards interactive materials, modernizing instruction and e-learning in general. Majority belives that is essential for their future professional achivments to use interactive didactic materials, on the one, and to design their own on the other hand. Furthermore, some of the participants even asked for help in pedagogical terms of appropriate use of modern teaching aids in order to easily facilitate student knowledge, motivation and curiosity.

VII. CONCLUSION

Expected outcomes of the two school years research and profesional training are reduction of low ICT integration in schools as well as answering to all relevant questions related to the subject.

After completed research activities it is planned not only to clarify and reduce causes of low ICT integration, but also and to solve problems as poorly engaded secondary school teachers in organized – formal and informal professional development as shown in this study. There are still remaining to clarify possible existance of gender differences in ICT integration as well as engaging and motivating teachers of all numbers of professional experience to activly design their modern currcula in ICT usage. To these and related issues future studies will provide answers.

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THE EFFICACY INCREASE OF USING THE PRESENT MEDIA FILES IN COMPARISON WITH THE ONES USED IN THE PAST

T. Križan, M. Pardanjac, E. Eleven
Technical Faculty „Mihajlo Pupin“, Zrenjanin, Republic of Serbia,
krizsitibi@gmail.com

Abstract - theory and empirical research in this work have been focused on solving a dilemma: are modern teaching tools needed in the classes of technical education. Modern tools are way efficient in comparison with the traditional ones.

I. INTRODUCTION

Most of researches of educational process have started with three main factors, which are its elementary components: student, teacher and the curriculum. However, the analysis of the present curriculum has shown that there is the fourth factor which links all the three ones mentioned before. This is the educational technology. Current pedagogues can use multimedia programs created for personal computers. These offer a possibility of making electronic teacher's books with text, pictures, audio animation and films, [1].

From artificially made educational tools teacher can use the following: audio tools (for the sound reproduction and the reproduction of the sound made by various tools), visual tools (texts, slides, pictures, applications, drawings, film strips, silent movies, graphics, maps, relieve, models, art works, various objects, etc.) and audiovisual tools (film, tape recording, TV program, materials shown by a video-system, cassettes, CDs, contents that are received via computer).

In practice, teachers usually combine educational tools and in way that makes the teaching perfect and more acceptable for students. Significant knowledge resources and teaching enhancement tools can be found in the contemporary equipped ***media libraries,*** [1]. For increasing the quality of teaching and learning, besides the library, there are tools of special pedagogic value: filio files, slides, sound recordings, video, film, graphic files, photo library, micro files, toy library, media files, soft files, and reprography. With the help of ***school media library*** the curriculum can be taught vividly and with quality, [1]. "A media library is both a library and information centre for educational technology, i.e. media library is a contemporary subsystem of the broader system of modern organization of school's educational system"[3, pg. 2.]

II. MEDIA FILES PROPERTIES

A media library is a specially arranged and equipped space which, besides that keeps special educational tools, enables a working space for teachers and students, in order to modernize teaching, [9].

"Informational technology in education offers a possibility of using new educational methods and a new organization of teaching"[1, pg. 4.]

A. Idea

Media library is the most contemporary educational center among school institutions equipped with the most modern technical equipment which enables a quality teaching. The phrase media library comes from a Latin word (mediatheque), where the word "medium" means mediator, the middle and the word "theca" means notebook, box, closet, [9].

B. Media library function and tasks

With its contents, a school media library enables to a teacher a programming of more educational tools that can be used as:

- In function of organizing teaching and learning
- In reciprocal function of media libraries
- In other media library functions
- In a computer which serves as a media library

C. The field of new conditions

To work in a media library is necessary to concentrate and mutually integrate, as well as prepare ourselves for direct and unrestricted modern technology: audio, visual and audio-visual. [9]

D. Media library staff

"A media librarian is a professional associate in educational process who does the planning, coordinates and organizes the work of media library" [9, pg. 28]

E. Education and the use of media library resources

There are two possible ways for the media librarian's education:

- In the process of everyday activity realized in media library
- According to special training requirements for browsing, handling and the use of information [9]

III. TRADITIONAL TEACHING TOOLS

A. Overhead projector

An overhead projector is a special type of a projector, with a purpose of showing various materials (maps, schemes, drawings, graphs, etc.). Its uniqueness makes this projector suitable and interesting for students of all ages, [1]. It was used until the eighties and the nineties of the 20th century.

An overhead projector is technically a very simple and economical teaching tool, which is maintained easily. It is rarely broken and for teachers easy to handle without any professional training, [1]. „The casing, dimensions of 30x30x30cm contained a powerful halogen lamp- of at least 250w, but often more than 500w.“ [6]

Because of high temperature, there was embedded a fan that cooled the lamp." The light came from above and went through a class lid of the casing. It would reflect from the mirror and at an angle. At the end, it would go through an appropriate lens and would be projected on the screen. The picture could get sharpened by the adjusting the mirror-lens system. On the top of the casing would go transparent plastic films which could be written to by a marker, which was the case later. Teachers used to put picture and text plastic films made in advance on top of the casing". [6]

Figure 1. An overhead projector [6]

B. Some of the overhead projector characteristics

Horizon overhead projector - this projector is very light (6.5 kg), because it is made of a special polymer material. It is foldable and easy to transport. It has become an inevitable part of every teaching institution and conference halls after just a year from appearance on the market, [3]

Figure 2. Horizon overhead projector[3]

Quadra overhead projectors - it is easy to use and of quality. The acknowledged Vega's optics ensures a safe and a quality projection of plastic films of the size A4. The cooling system is silent and efficient. The casing is robust and made of metal, which ensures an additional stability with handling, [3].

Figure 3. Quadra overhead projector [3]

C. Audio media

This group contains teaching tools, such as radio shows, gramophone recordings, tape and CD recordings, [1].

D. Radio in teaching

There was a possibility of enhancing the teaching with the help of radio by preparing shows about current events.This technique is now updated, and the digital one is used

E. Tape recorder in teaching

A classical tape recorder is a technical teaching tool which can be equalized with the radio recorder by its properties and the way of use. With the help of tape recorder, can be recorded sounds from different sound sources and then broadcast the different contributions, [1].

Tape recorders and sound recorders can be used in the teaching very successfully, especially on the music classes, foreign languages classes and in the mother tongue classes, [1].

Figure 4. Tape recorder [10]

IV. MODERN TEACHING TOOLS

A. Electronic computers in teaching and learning

Modernization of teaching and learning represents a form of work advancement to the education based on introducing the educational system in technological environment of the IT society, [1]. There have been significant innovations with the introducing of electronic computer in the modern teaching. Without them, the modern teaching is unthinkable. They are used in different forms of work. Computers enable easier learning and quicker mastering of the subjects. The learnt materials are easy to remember and for a long time, [4].

„It is very important that students treat the computer in the same way, and to make students initiative for work, give them equal chances for work and make possibilities for their self improvement. A weaker student gets help in order to progress without obstacles and in the highest possible.” [5, pg. 3]

Figure 5. Electronic computers [3]

B. Video projector

Video projectors are modern, portable and compact devices which show the audio-visual recorded signal from computer and video system onto the screen. Video projectors of new generations, for their strong light sources make an excellent choice for showing teaching films to a limited number of students.

Video projectors enable showing the film contents on a big space. They have a great perspective in the teaching case. They are here to replace a board, chalk and overhead projector and other sorts of projectors, [1].

Video projectors are sorted into groups according to their general purpose:

- For home purpose
- For educational needs
- Portable projectors
- Conference projectors[8]

The installation of video-projectors can be made in three ways:

- Ceiling installation
- Wall installation
- Table or desktop installation[7]

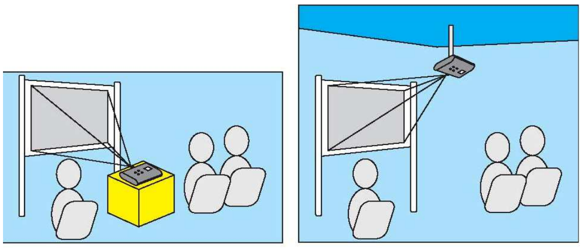


Figure 6. Video projector setting [7]

C. Projection screen

There are a few sorts of screens in use. They are sorted according to the conditions in which they are used: for projection in a dark space, and for projection on daylight. An important lack of projecting in a dark space is that the classroom is needed to be in total dark. This can be made by special curtains, which are put on the window. In the conditions when the daylight is strong, the wall screen is used. The wall surface needed is previously prepared and framed with black paint. This surface should be protected from damaging, defilement and similar. One of these screens is a portable one with a stand, which contains a metal pole, a demountable stand and a screen. The screen is made of impregnated white sheet of metalized surface. The screen is vertically situated and the angle picture quality enhancement is made with moving of projector to the screen by the angle, [1].

Figure 7. Projection screen-example [8]

V. Research Methodology

A. Scientific research methods

Since there is the introduction of the modern technology in the process of study such as computer, this work is about applied experimental research.

Experimental method (project making in both ways, in two classes, one from Elementary School “Moša Pijade” in Pačir, the other from Elementary School “Vuk Karadžić” from Bajmok. I teach one class in a traditional way, in the other I do the same thing, but with modern method. The method is analysis (the analysis of new knowledge).

B. Research procedure and instruments

Research procedure- work in class. Instrument- interview with students, survey

C. Expected outcome

Modern teaching tools enable a level of sensory knowledge that suggests things, appearance, and their features. It provides a better way of learning, gives conditions for better memorizing, recognizing and the use of the learned materials.

The expected outcome of this research is to show the validity of the idea of introducing the computers into the regular teaching:

- Thanks to the teaching tools, students learn by investigating, research and problem solving. They motivate them on mobility and independence.
- A teacher will easily adjust the teaching to the student’s previous knowledge, interests and abilities by using the teaching tools. The teaching curriculum will be successfully accomplished and enable an active participation of students on classes.
- Teaching tools contribute to a faster modernization of features, methods and procedures in teaching
- Well organized experimental check
- Children’s interest in this kind of work

VI. Processing and Ordering the Research Outcome

In the process of my work, I compared reactions of two classes which I taught the same curriculum, how they react during the teaching and processing of the curriculum. In this way, I have been trying to compare the effect of modern and traditional tools.

I teach one class with pictures and books, and the other with new technology. I do this with a projector and a laptop. I inserted a short film, music, pictures and tables.

A. Classes and research instruments

„Moša Pijade“ Elementary School eight graders are taught by old teaching tools. Students- 28 boys, 28 girls

„Vuk Karadžić“ Elementary School eight graders are taught by new teaching tools- a presentation projecting. Students- 56 boys and 52 girls.

Teaching unit used in the research: Electrical Conductors

First level: anonymous survey after the class (new unit)

Children were asked about the quality and how interesting was the class.

Were the units interesting? (circle the answer)

Yes or no

Second level: anonymous survey, should we introduce these working methods?

Yes or no

B. Results of research

First level of research

After questioning the children, here are the results about their opinion: students from „Moša Pijade“ Elementary School: Yes: 24 No: 32; students from „Vuk Karadžić“ Elementary School: Yes:76, No: 32

Conclusion no.1

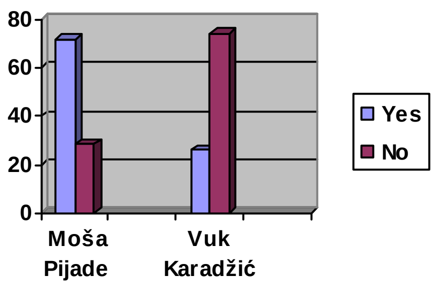
The survey showed that only 42,85% of students in „Moša Pijade“ Elementary School enjoyed the class, while 51,14% announced that they didn't like this way of teaching. 70,37% of 27 students in „Vuk Karadžić“ Elementary School announced that the teaching was interesting and 29, 62% of them announced that they didn't like the class.

Research level 2

Here are results after children being asked about their mood on class: students from „Moša Pijade“ Elementary School: Yes: 40, No: 16; students of „Vuk Karadžić” Elementary School: Yes: 28, No: 80

Figure 8. Results of research level 2

Conclusion no.2



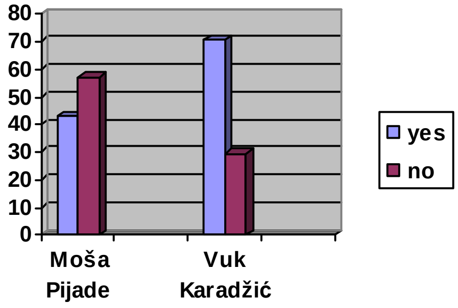


Figure 9. Results of research level 2

71,42 % students of Moša Pijade Elementary School, voted yes, for using the new teaching tools in class.

74,07% Vuk Karadžić Elementary School, said they liked the class. In their opinion, there is no need of introducing new methods.

VII. Conclusion

Modern teaching tools are a possible and efficient way, even more efficient than traditional ones. They reduce the number of teaching tools which teachers used in the traditional teaching. This contributes to rationalization, intensification, and modernization of teaching. For example, a computerized learning machine can present any teaching content of quality showing a picture, sound, text, drawing, graph, etc. It can demand of students to perform different activities, repeat contents, solve tasks, ask questions and debate with the machine.

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E-LEARNING

POSSIBILITIES OF APPLICATION RECOMMENDATIONS IN A COLLABORATIVE WEB ENVIRONMENT FOR E-LEARNING

E. Kadić, N. Bijedić
Fakultet Informacijskih tehnologija, Mostar, Bosnia and Herzegovina
elvis.kadic@edu.fit.ba, nbijedic@edu.fit.ba

Abstract - Inspiration for this paper was a result of a fact that modern society sees the virtualization in its full meaning. In that never-ending process, there are many virtual environments that offer different forms of collaboration among users or groups of users, which include revolutionary concept of e-learning, as well. This paper will try to make specific progress in the field of recommendation system in order to provide students more comfortable virtual environment. In order to implement such an idea, we have realized *FITCKM* – a system at Faculty of information technologies in Mostar, whose data were used for testing of different recommendation models with the emphasis on adaptive-aggregation approach.

I. INTRODUCTION

The beginning of the XXI century marked the beginning of the development of the recommendation system in the context of e-learning where different techniques recommend users to on-line resources, activities or paths of research based on their characteristics as well as activities of their fellow students what takes into account the social component of learning process.

Although very similar to adaptive hypermedia applications, which during the adaption of hyper connections take into account different aspects of users (such as prior knowledge, interests, goals, etc.), recommendation systems are often limited to a single aspect called user's interest[1]. The research in this field is aimed at overcoming of this omission. That is very important for the education context in terms of availability and adoption of new knowledge.

By using the recommendation system in the context of hypermedia educational application we can directly connect to new approaches in development of educative environment on web that are emphasizing the importance of collaborative learning. Collaborative learning is based on constructivist theory, which puts the student in the centre of the educational process and supposes that students are learning from each other while participating in different activities. One of the basic goals of numerous adaptive hypermedia systems is delivery of teaching materials so that the support for collaborative learning represents a new chance for implementation of adaptation [2].

This paper has focused its research on adaptive recommenders by using combination of standard recommendation models that are used in practise for several years. Simulation of the intelligent software agent was used as an additional technique that contributes to preciseness of the recommendation. In the practical part, collaborative system for knowledge management (*FITCKM*) was developed as well as experimental environment for testing of different approaches to recommendation. In the experimental environment, we have used real data *FITCKM* system and external sources *MovieLens* (free of charge film collection), which, based on its characteristics matches the planned tests and the most often, it is used for research in this field.

II. SCOPE AND THE PURPOSE OF THE RESEARCH

Scope of the research is the possibility to use different recommendation systems in collaborative environment that, among other things, can serve as a support to independent virtual communities for e-learning or traditional LMS or VLE systems.

Standard models such as *person correlation, cosine similarity, slope one, item average, SVD and the like,* are the most common choices when implementing the recommendation system. Nevertheless, the development of different aggregation forms is caused by discovering different problems and imprecision in individual use of these methods where standard models are combined based on certain parameters. Certain problems of standard models are solved by aggregation approaches. However, significant success in preciseness of the recommendation was not achieved [11]. Conscience decision making on choosing an adequate pattern of recommendation in the phase of designing the recommendation system is often considered as a limiting factor [11]. Before any kind of modelling of users or resources, the researcher or programmer chooses one or several methods that are most adequate for creating a universal model. Therefore, modelling of users or resources is based on the presumption, what in the basis of subjectivity is not a desirable effect. This phenomenon is a classical problem of latent subjectivity [4].

The algorithm priority should be based implicitly and automatically on success of prior effect for individual users and resources. A set of users and resources is often too big. Therefore, it would not be possible, for a single or generalized combination of methods, to accumulate possible nuances of important predictions [4].

In order to solve this problem, some authors propose a new method based on adaptive recommendation (AR) [4]. In relation to traditional recommendation systems, AR supposes a new level of abstractive and personalization and the decisions are made implicitly without additional explicit interaction.

Adaptive recommendation with the simulation of the role of intelligent software agent is a concept used in this paper to address a standard problem in this field such as latent subjectivity and information overload.

By applying detailed analysis of advantages and weaknesses used in this paper, one of the basic goals was to provide the user with interesting, useful and comfortable collaborative web environment for e-learning. There is a genuine hope that the result, that is, the purpose of this paper, will be an achievement of certain improvements in the field of collaborative knowledge management and recommendation systems, and that the new ides might determine the direction of future research. This does not apply exclusively to domain of e-learning. However, eventually improved concepts could be used in different scenarios.

III. IMPLEMENTATION OF *FITCKM* SYSTEM AND EXPERIMENTAL ENVIRONMENT

Practical part of this paper comprised of two segments. In the first part, we have explained the most important parts in development of *FITCKM* system, i.e. collaborative web environment for e-learning designed for exchange of information among users. Data on users' activities in the system were stored in the database and would be used in experimental environment for testing of different recommendation systems. Experimental part was presented in the second part of this chapter. Besides the mentioned data, we will use external data collection in the experimental part in order to test as authentically as possible the possibility to use a recommendation system.

A. Fitckm system

When developing the *FITCKM* system, we paid particular attention to modelling of users and resources, that is, to significant data the system is recording about them. The final purpose of the application primarily was to support the users in the process of e learning in terms of collaboration and adaptive navigation aimed individual interests.

For the design of the FITCKM system, we used following applications:

- Microsoft Visual Studio 2013, SV 12.0.21005.1. REL
- Microsoft SQL Server 2014 Management Studio

1) Fitckms – system modules

FITCKMS is composed of two modules: Wiki page and Questions and Answers. Wiki page is a module where we have implemented the basic functionality of *Wikipedia*. In addition, we have enabled explicit evaluation of articles via rating or liking or disliking. *Module Questions and Answers* is very similar to *Wiki module* and its basic purpose was creation of knowledge base, that is, enabling activities related to asking questions and finding answers.

2) Fitckms – Data base

Based on collected and analysed demands, we have designed a *FITCKM* system relation database. Two basic tables User and Post have a central place in the star structure. Their system entries are seen as recommendation objects. The role of supporting tables is to keep the value for different specificities/generalisation of basic tables or to connect them in a foreseen way.

3) Fitckms – Overview of the application possibilities

Basic functionalities of *FITCKM* system are registration and signing up of users, designing, editing, commenting, evaluating (rating, liking, disliking), searching and recommending of resources.

B. Experimental environment

In order to research and test the ideas mentioned in the introduction of this paper, we developed an experimental environment. The source code was made in *Java* programme language, *Eclipse* [5] environment and the following versions of *Apache Mahout^{TM}* were used as a basic library:

- Eclipse Standard/SDK, Version. L. R. (4.4.0)
- Library, Apache MahoutTM, Version 0.9

We integrated basic algorithms for grouping, classifying and collaborative filtering in Apache *Mahout^{TM}* library.

Packages and class libraries were used for testing of different recommendation models. Besides the standard models already used in practice, particular attention was paid to testing of adaptive- aggregation method.

We used *MovieLens* data collection for testing. It is the most used data collection for testing of recommendation systems performances [3]-[7]-[8]-[9]. It comprises of set of users, films and users' evaluations for films on the scale from 1 to 5. MovieLens collection is available in several formats and sizes and for this experiment; we chose the subset of MovieLens collection with 100.000 evaluations by 943 users and 1.682 films.The data structure of the mentioned collection was very similar to data structured used by *FITCKM* system that will be also used when testing.

IV. METHODS

In this chapter, we have described the methodology used in this paper that relates to recommendation systems, error estimation and intelligent software agent.

A. Recommendation systems

Improved usage of standard methods and algorithms that is, adaptive-aggregation approach to recommendation system would result in certain improvements in design of user model and with that in preciseness of the recommendation.

The driving idea is very simple and because the quality of the recommendation does not depend only on preciseness of methods used but on diversity of the sets, processing and data aspects. The same data cannot be used in different contexts, that is, it cannot be observed from different perspectives. In other words, the meaning of data can be interpreted in different ways, depending from the fact if the data are observed individually or in correlation with other data. This approach enables us to find hidden, potentially valuable information, i.e. objects whose relevance would be additionally investigated.

To realize this idea, we used standard statistical methods to explore different mechanisms of unknown connection among data. It certainly involves the usage of qualitative data sets that are matching the real data systems in terms of their structure and size.

In order to find disjoint patterns in the data, we need to define methods that are processing data from different aspects. Table 1. shows the selected recommendation systems for experiments. The first column relates to the type of recommendation systems where the letter *(S)* stands for standard systems and letter *(A)* for aggregation. All mentioned aggregation methods use the results of all standard recommendation models.

TABLE 1. RECOMMENDATION SYSTEMS

	Methods	***Algorithm***	***Description***
S	PCC	Pearson correl.	Similar users
S	cosine	Cosine similarity	Similar resources
S	baseline	Baseline	Averages of users and resources
S	Item avg	Baseline	Standard resource averages
S	Slope one	Slope One	Delta rating account
S	svd1	SVD	ALSWR factorizer, 10 function
S	svd2	SVD	ALSWR factorizer, 20 function
S	svd3	SVD	SVD++factorizer, 10 function
S	svd4	SVD	SVD++factorizer, 20 function.
A	median	Aggregation	Mediana of aggregation raitings
A	average	Aggregation	Average of aggregation ratings
A	adaptive	Adaptive Aggreg,	Adaptive aggregation ratings

B. Error estimation

In order to evaluate the model during prediction, we need to determine the measurement for calculation of total error in large number of prediction. The usual measurement for estimating the recommendation system error is RMSE (root mean squared error) measurement [10]-[3]-[9]. RMSE is usually used when presenting the deviation between the prediction and current rating and it can be shown by using following formula:

$$\boldsymbol{RMSE}(\widehat{\boldsymbol{R}}, \boldsymbol{R}) = \sqrt{\frac{\sum_{i=1}^{n}(\widehat{\boldsymbol{R}}-\boldsymbol{R})^2}{\boldsymbol{n}}} \qquad (1)$$

In formulation (1) $\boldsymbol{n}$ is a total number of predictions. Previous formulation combines the set of errors in one combined error in a way that it compares the set of evaluated predictions $\widehat{\boldsymbol{R}}$ to set of current rating values $\boldsymbol{R}$.

Useful characteristics RMSE measurement is that the result of the error will be on the same scale as the estimation. For example, if we estimate the values on a scale 1 to 5, calculated errors will be on a same scale. Concretely, if the error's value is 1 then we can conclude that the distance from the correct estimate is 1 in average.

RMSE represents a non-linear way of error estimation, which means that major errors face more strict sanctions. Due to square difference in formulation, few major errors have bigger impact than numerous small errors. Therefore, in RMSE approach, advantage is given to methods that have more stable predictions in comparison to precise methods, which due to few users or resources do not have desired results. RMSE is used to evaluate the preciseness of all standard and aggregation methods used in experiments.

C. Intelligent software agent

In terms of improvement of data quality, predictions and recommendations, we have simulated the role of intelligent software agent. The agent is in charge of dynamic design of user model, that is, immediate processing of important data. Concrete objects, that is, content of the message in *FITCKM* system are users' posts as well as the very users. Besides the dynamic notifications to user (logging, new posts closest to the neighbours, new comments, new ratings or liking his/her posts, new answers to questions where the user in a way has participated and the like), agent has even more important tasks. They can simply be described as dynamic storing of important information on current state of the environment, concluding and reacting on their basis in real time [11].

Current rating of observed user and its meaning in future system activities can serve as an example for the aforementioned. Based on the history of user movement through system and current situation of the environment, among other things, the agent is in charge, of dynamic estimation of user's rating. Basis for this concept is that the evaluation of specific resource has different values in comparison to individual rating of the user who is evaluating that very resource. In other words, the system will appreciate more the opinion of the user that has higher rating then the opinion of the user with lower rating. Therefore, the dynamic estimation of the value of opinion (evaluation of other users' posts) of currently active observed user impacts the dynamic evaluation of the opinion of other system users. In order to use this concept in the system, the agent must "listen" to the environment and timely react to certain happenings in the system [11].

Concrete events that agent should change and potentially react, can be different: new post, comment, chat, article version, signing in or signing out of users, change of user's rating or post. The knowledge on this data is stored in databases. The agent's reaction depends on system perception, that is, decision if the change in the environment is relevant for specific user.

When calculating the rating (Badge) of the user, we do not use only the number of edited posts (articles, chats, questions or answers) but also their quality. Quality of the post is determined by the number of points user won based on the opinion of other users, via post evaluation (ranking, liking, and disliking). Post can won certain medals based on the number of points. In the programme code of the intelligent software agent, medals are symbolically named as bronze, silver and gold medals. They are numerically determined in a following way: *bronze – 10 points, sliver – 20 points and gold – 40 points*.

Due to the change of the post's medal, we start the calculation of the rating of owner's post. If necessary, the owner is awarded with corresponding badge. For example, for a pioneer badge, the user must have five bronze medals, at least, and for junior badge at least three silver medals. By using similar logic, the badges are awarded until the level of academic is reached where user must have at least twenty gold medals. The system considers the academic user's opinion as the most valuable.

This kind of concept is provided in such a way that the badge represent a weighted value, which is used when evaluating the posts. Users can have 10 different types of badges in *FITCKM* system. They are awarded based on a corresponding weight on the scale from 0,6 to 1,0 (Table 2.).

TABLE 2. THE WEIGHT OF THE BADGES

Badge	**Weight**	**Badge**	**Weight**
Academic	*1*	*Student*	*0,69*
Doctor	*0,92*	*Senior*	*0,65*
Professor	*0,85*	*Junior*	*0,63*
Master	*0,79*	*Pioneer*	*0,61*
Ennginеer	*0,74*	*Beginner*	*0,6*

Calculation of the final evaluation can be shown by using this simple formulation:

$$\boldsymbol{fri = wb * r,} \tag{2}$$

In the formulation (2) final evaluation of the post ***fri*** represents a product of evaluation ***r*** on the scale from 1 to 5 and the weight of the badge of the user ***wb*** who is evaluating the post. For example, if the user who is evaluating the post "has a badge of professor" and evaluates specific post with 4 by using the formula, final evaluation will have the value of 3,4 (4x0,85=3,4). Nevertheless, if the user has a "badge of the student", post evaluated with 4 will have a final value 2,76 (4x0,69=2,76) [11].

Estimations, produced by using this concept, are stored in the database and as such are used for evaluation. It is necessary to mention that the change of the user's badge affects only the future evaluation, the evaluation given in the past when user had a different badge stay unchanged.

The majority of past solutions dealing with the problems of user rating are mainly based on simple evaluation and quantity of edited posts, they do not consider quality. By implementing the described concept, some very logical situation may occur. For example, it is possible that a specific post has a large number of positive evaluations by low ranked users and some other has a small number of positive evaluations but from highly ranked users. This means that it is possible that other post has higher-ranking value in comparison to the first one, even if it has less positive evaluations. In such a case, the environment decides on the total ranking of the user, i.e. other users whose opinion was not evaluated in the same way. Therefore, the evaluation of the resources in the combination with the weighted rating represents dynamically calculated value that solely depends on current situation of the environment. [11]

From the perspective of the recommendation system, the usage of such kind of agent can improve the quality of input data in algorithms i.e. it can improve the quality of the recommendation system. In addition, non-evaluated posts can be seen differently in the recommendation system because in this case they could be ranked based on the ranking of the owner what opens new possibilities and ideas in the future development of this kind of systems.

After defining of methods and sets of data, we have started with experimental phase. On the first layer of modelling, we carried out the estimate of preciseness of all standard methods and by using error-model and we have presented the results as deviation from the real estimation. The obtained values are used on the other layer of modelling when determining the weight of all used standard methods. The weight, with the normalisation of errors, determines how much each of the defined algorithms is engaged in the adaptive recommendation.

By comparing the results obtained with or without the usage of intelligent software agent, we have carried out the additional evaluation of the preciseness evaluation.

V. EXPERIMENTS AND RESULTS

TABLE 3. RECOMMENDED RESOURCES (*FITCKMS* DATASET)

type	***method***	**1**	**2**	**3**	**4**	**5**	**6**
S	*Pearson*	4205	4180	4179	4181	3154	4174
		4,535	4,464	4,348	4,302	4,293	4,000
S	*cosine*	4204	4193	4189	4187	2131	4199
		4,000	3,666	3,664	3,572	3,567	3,550
S	*baseline*	4178	4196	4171	3142	3154	4204
		4,391	4,391	4,391	4,391	4,266	4,141
S	*itemavg*	4189	4193	4169	4183	4179	2130
		3,665	3,664	3,508	3,506	3,506	3,506
S	*slopeone*	4189	4196	4171	3142	4204	4190
		5,500	4,500	4,500	4,250	4,250	4,000
S	*SVD_1*	4176	4208	3154	4203	4199	4202
		4,070	2,938	2,407	2,358	1,805	1,770
S	*SVD_2*	4196	3142	4171	4178	4192	3154
		3,661	3,626	3,542	3,496	3,425	3,372
S	*SVD_3*	3154	4180	4174	4173	4181	3145
		4,088	3,676	3,631	3,609	3,592	3,575
S	*SVD_4*	3154	4180	4174	4173	3145	4181
		4,145	3,738	3,698	3,641	3,629	3,628

In Table 3. the rows represent standard methods and columns top 6 recommended resources over the *FITCKMS* data set. In the upper cells are unified identification numbers and in the lower are rating values for corresponding resource. Without considering the relevance of recommended resources, the difference of all results indicate that applied standard methods use different forms among data, that is, the relations between data are observed differently in the majority of methods.

TABLE 4. RECOMMENDED RESOURCES (MOVIELENS SUBSET D1)

type	***methods***	***1***	***2***	***3***	***4***	***5***	***6***
S	*Pearson*	212	515	639	640	86	170
		5,000	5,000	5,000	4,500	4,500	4,500
S	*cosine*	1654	1500	1477	1417	1390	1243
		4,375	4,285	4,250	4,250	4,250	4,250
S	*baseline*	1599	1653	1467	1122	1500	1189
		4,427	4,427	4,427	4,427	4,427	4,427
S	*itemavg*	1354	114	515	206	1654	654
		5,000	4,494	4,400	4,386	4,3705	4,304
S	*slopeone*	1080	1368	1367	1293	1233	1344
		5,500	5,407	5,166	5,000	4,916	4,629
S	*SVD_1*	1367	1643	1167	1385	1160	320
		5,132	5,126	4,771	4,700	4,648	4,633
S	*SVD_2*	851	1467	1347	1642	867	1524
		4,468	4,356	4,339	4,318	4,301	4,203
S	*SVD_3*	318	515	64	483	302	127
		4,690	4,631	4,618	4,595	4,589	4,561
S	*SVD_4*	483	64	318	12	603	127
		4,757	4,731	4,707	4,700	4,666	4,608

Results in the Table 4. confirm the difference of recommended resources i.e. that chosen standard methods use different forms when generating data over the subset *d1 (MovieLens Collection).*

Table 5. shows the results if error estimate for all methods that are included in the experiment. Collection of data MovieLens is divided into 5 disjoint sets in columns d1, d2, d3, d4 and d5. In this way, we have provided reliability of data that can be interpreted as random. Column d6 represents a collection of data FITCKM system that is, as it is mentioned, of a much less scope.

TABLE 5. RMSE VALUES OF RECOMMENDATION SYSTEM

type	*methods*	*d1*	*d2*	*d3*	*d4*	*d5*	*d6*
S	*Pearson*	1,247	1,168	1,238	1,220	1,237	1,166
S	*cosine*	1,039	1,048	1,105	1,048	1,052	1,223
S	*baseline*	0,972	0,974	0,977	0,983	0,982	1,588
S	*itemavg*	0,971	0,960	0,983	0,992	0,978	1,725
S	*slopeone*	0,947	0,956	0,965	0,962	0,957	1,713
S	*SVD_1*	1,005	1,006	1,004	0,997	1,006	2,041
S	*SVD_2*	1,008	1,018	1,023	1,017	1,028	1,684
S	*SVD_3*	1,090	1,092	1,089	1,107	1,102	1,256
S	*SVD_4*	1,073	1,077	1,075	1,122	1,121	1,259
A	*median*	0,796	0,803	0,805	0,801	0,807	1,304
A	*average*	0,812	0,807	0,815	0,819	0,823	1,250
A	*adaptive*	0,721	0,717	0,724	0,727	0,731	1,095

In cells of Table 5. We can find RMSE values for all recommendation systems. Lowe RMSE values represent better results.

Table 6. shows top 6 recommendation results for randomly chosen specific user (unified identifier 5) by using standard methods of the above sets.

TABLE 6. COMPARISON OF RESULTS OF THE STANDARD METHOD RECOMMENDATION ON DIFFERENT SETS FROM THE *FITCKMS* DATABASE

method	*ranking*	*1*	*2*	*3*	*4*	*5*	*6*
Pearson	*r*	4205	4180	4179	4181	3154	4174
	pr	4205	4181	4179	3154	2130	4180
cosine	*r*	4204	4193	4189	4187	2131	4199
	pr	4204	4193	4189	4187	2131	4199
baseline	*r*	4178	4196	4171	3142	3154	4204
	pr	3142	4196	3154	4183	4178	4204
itemavg	*r*	4189	4193	4169	4183	4179	2130
	pr	4189	4193	4169	4183	2130	3158
slopeone	*r*	4189	4196	4171	3142	4204	4190
	pr	4189	4196	4204	4190	4171	3142
svd_1	*r*	4176	4208	3154	4203	4199	4202
	pr	4187	4199	3160	4183	4179	3144
svd_2	*r*	4196	3142	4171	4178	4192	3154
	pr	4180	3145	4195	4169	3160	4189
svd_3	*r*	3154	4180	4174	4173	4181	3145
	pr	3154	4205	4180	4181	2130	4186
svd_4	*r*	3154	4180	4174	4173	3145	4181
	pr	3154	4205	4180	4181	2130	4186

In table 6. The first column represents standard recommendation methods tested on the set with standard estimation with the letter r and set with weighted estimate with letter pr (column 2). Other columns (1 to 6) represent top 6 recommended resources for both 6. The cells represent unified resources identifier in the database. The differences in estimation are given in grey colour by using the same standard methods on mentioned sets. The number of elements in both sets is very small (cardinality 230) and achieving any kind of difference in estimation represent an excellent result. Real estimate is that in bigger sets this difference would be even more visible.

VI. CONCLUSION

In this paper, we have shown the basic viability of adaptive-aggregation recommendation models with simulation of intelligent software agent in the role of increase the quality of input data in algorithms of these models. Any kind of progress in this field would represent a great success for future research. Nevertheless, the application and possibilities of considered approaches could have much broader settings then it is given in this paper.

Intelligent software agent in experiments has, for a fact, created a new knowledge and enabled the system to use different data dimension. Through new roles and dynamic reactions to specific events, this knowledge could be additionally widened and combined in concluding i.e. raising the system “awareness”. The problem of latent subjectivity is often neglected and it prevents the standard recommendation methods to achieve their full potential. Basic idea of these systems is to predict unknown estimate for resources based on the pattern used when estimating other resources. Their individual performance is different from system to system and it depends on users and resource of the very system. Modern approaches to aggregation recommendation systems use different forms, mainly at the generalized level, because the users and resources are treated the same what violates the basis of subjectivity. The approaches that use average or predefined weights of models, assume that the best average is at the same time the best estimation result for all individual users or resources. Latent subjectivity represents comprehensive problem that very often, can be detected in different methods of mechanical learning [11].

Adaptive recommendation systems can represent certain progress when solving this problem. Adaptive approach to recommendation can estimate the errors and adapt the preciseness of estimation for individual resource. It leads to the conclusion that this kind of approach is applicable even beyond the recommendation system and that there is a possibility to achieve much better results that those obtained in the experiments carried out for the purpose of this paper. It would be interesting to examine the adaptive approach potential in social networks or systems that foresee relevance of very different resources.

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AN OVERVIEW AND PERSPECTIVE OF E-LEARNING BASED ON CLOUD COMPUTING

L. Ratgeber[*], N. Petrov[**], M. Zakin[**], S. Stanisavljev[**], B. Markoski[**]
[*]PTE-ETK University of health sciences Pecs – Doctor School, Hungary
[**]University of Novi Sad, Technical faculty "Mihajlo Pupin" Zrenjanin, Republic of Serbia
nikola.petrov@tfzr.rs

Abstract - E-learning as a type of education which is becoming increasingly popular and constantly developing, because of the benefits it offers. Certainly the most important advantages of e-learning are: distance learning, remote lectures, learning materials in various electronic forms. However, because of all these advantages mentioned above, number of users is constantly increasing. That is the reason why the educational institutions and their e-learning systems leads to the problem of lack of resources, which increase the cost of these systems. Therefore, requirements for implementation and maintenance of these systems are becoming increasingly complex. In this paper, we will show how new ICT trends can contribute to overcoming above-mentioned problems, contribute to efficiency and economy system for e-learning, in particular: cloud computing.

I. INTRODUCTION

In recent years e-learning has grown into a widely accepted learning model. Innovative changes of e-learning applications have also been witnessed.

Recently the research community has believed that an e-learning ecosystem is the next generation e-learning [1].

However, in traditional web-based e-learning mode, system construction and maintenance are located in interior of educational institutions or enterprises, which results in a lot of problems existed, such as a lot of investment needed, but without capital gains to return, without development potential and staying power. Cloud computing is becoming an attractive technology due to its dynamic scalability and effective usage of the resources; it can be utilized under circumstances where the availability of resources is limited.

Cloud Computing is a new paradigm that provides an appropriate pool of computing resources with its dynamic scalability and usage of virtualized resources as a service through the Internet. The resources can be network servers, applications, platforms, infrastructure segments and services.

As cloud computing has become a research hotspot among modern technologies, researchers pay more attentions to its applications. As concerned as cloud computing applied in the field of education, a lot of problems had been studied, such as the technology for future distance education cloud , teaching information system, the integration of teaching resources, teaching systems development [2].

II. E-LEARNING

E-learning includes all forms of electronically supported learning and teaching.

The information and communication systems, whether networked learning or not, serve as specific media to implement the learning process. This often involves both out-of-classroom and in-classroom educational experiences via technology, even as advances continue in regard to devices and curriculum. Abbreviations like CBT (Computer Based Training), IBT (Internet-Based Training) or WBT (Web-Based Training) have been used as synonyms to e-learning.

E-learning is the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual education opportunities and digital collaboration.

It is commonly thought that new technologies can make a big difference in education.

In young ages especially, children can use the huge interactivity of new media, and develop their skills, knowledge, and perception of the world, under their parents' monitoring, of course.

Many proponents of e-learning believe that everyone must be equipped with basic knowledge in technology, as well as use it as a medium to reach a particular goal. E-learning is widely used today on different educational levels:

- continuous education,
- company trainings,
- academic courses,

There are various e-learning solutions from open source to commercial. There are at least two entities involved in an e-learning system: the students and the trainers. Some benefits of e-learning are discussed below:

- Time: One of the key benefits of online study is that one can learn or take a course through e-learning at any time as it is convenient for them. Podcasts and downloadable lectures mean that students are no longer constricted by a conventional timetable of lectures.
- Location: Neither are students restricted by their physical location. With an Internet connection, they can attend live online tutorials, participate in dedicated discussion forums or download course material and notes regardless of where they are.
- Communication: Another key advantage of online study is that it encourages and enables students to collaborate and communicate with their fellow students as well as their tutors.
- Improved training and material costs: With e-learning, each time the course is accessed our return on investment improves because users are dividing the fixed production costs by number of uses. We also have savings through decreased travel, reduced material, and hopefully improved (and more efficient) performance.
- Increased productivity: Because e-learning is not bound by geography or time, you can control training’s impact on production by training people during down times. In addition, with the current economy, you’re asking people to do more with less [3].

III. CLOUD COMPUTING

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [4]. The rise of Cloud Computing is rapidly changing the landscape of information technology, and ultimately turning the long-held promise of utility computing into a reality. The latest emergence of Cloud Computing is a significant step towards realizing this utility computing model since it is heavily driven by industry vendors. It attracts business owners due to its ability to eliminate the provisioning plan overhead, and allows enterprises to start from the small scale and dynamically increase their resources simultaneously with the increase of their service demand. Cloud computing promises to deliver reliable services through next-generation data centers built on virtualized compute and storage technologies. Users will be able to access applications and data from a Cloud anywhere in the world following the pay-as-you-go financial model [5].

Cloud computing uses remote servers and Internet to manage data and its applications, as it allows various clients to access network without installation in personal level, but the relevant data can be accessed anywhere via Internet. This technology praises for modeling of computer, because it approves different architectures, like centralizing storage, memory, processing and bandwidth. Different cloud models can be accessed based on its price and availability on demand [6].

Cloud computing can describe services being provided at any of the traditional layers from hardware to applications (Figure 1). In practice, cloud service providers tend to offer services that can be grouped into three categories: software as a service, platform as a service, and infrastructure as a service [7].

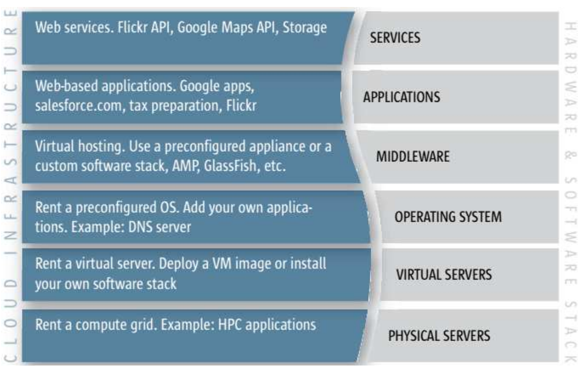

Fig. 1. Cloud computing means using IT infrastructure as a service

IV. FROM TRADITIONAL E-LEARNING NETWORK TO CLOUD E-LEARNING

E-learning is an Internet-based learning process, using Internet technology to design, implement, select, manage, support and extend learning, which will not replace traditional education methods, but will greatly improve the efficiency of education. As e-learning has a lot of advantages like flexibility, diversity, measurement, opening and so on, it will become a primary way for learning in the new century as in Fig. 2.

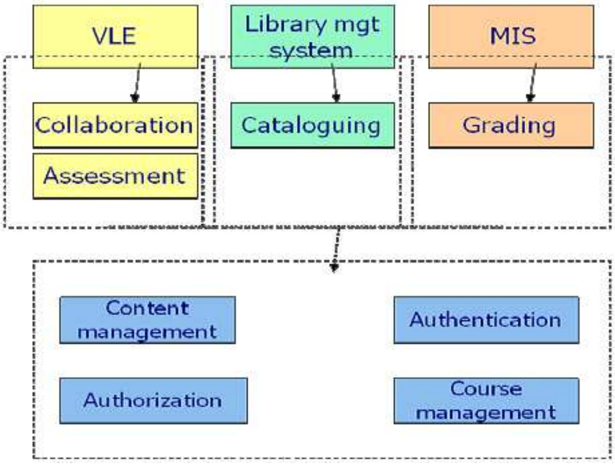

Fig. 2 Architecture of a simplified Learning System

Traditional web-based learning mode, system construction and maintenance are located inside the led to a lot of problems, such as significant investment needed but without capital gains for them, which leads to a lack of development potential. In contrast, cloud-based e-learning model introduces scale efficiency mechanism, i.e. construction of e-learning system is entrusted to cloud computing suppliers, which can make providers and users to achieve a win-win situation. The cloud-based environment supports the creation of new generation of e-learning systems, able to run on a wide range of hardware devices, while storing data inside the cloud.

The e-learning system can be scaled, both horizontally and vertically, and the educational organization is charged according to the number of used servers that depends on the number of students as in Fig. 2.

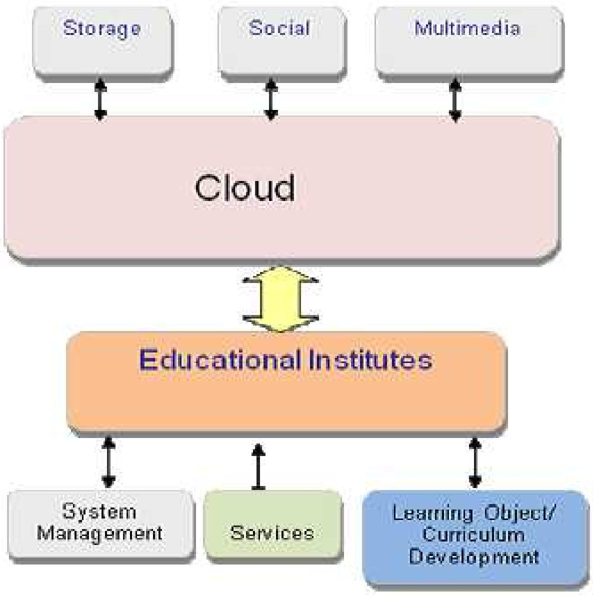

Fig. 3 Modified E-learning System Architecture

V. CLOUD BASED E-LEARNING ARCHITECTURE

The e-learning cannot completely replace teachers; it is only an updating for technology, concepts and tools, giving new content, concepts and methods for education, so the roles of teachers cannot be replaced. The teachers will still play leading roles and participate in developing and making use of e-learning cloud. The blended learning strategy should improve the educational act. Moreover, the interactive content and virtual collaboration guarantee a high retention factor.

On the other hand, E-learning cloud is a migration of cloud computing technology in the field of e-learning, which is a future e-learning infrastructure, including all the necessary hardware and software computing resources engaging in e-learning. After these computing resources are virtualized, they can be afforded in the form of services for educational institutions, students and businesses to rent computing resources.

E-learning cloud architecture is shown in Fig. 3[10][11].

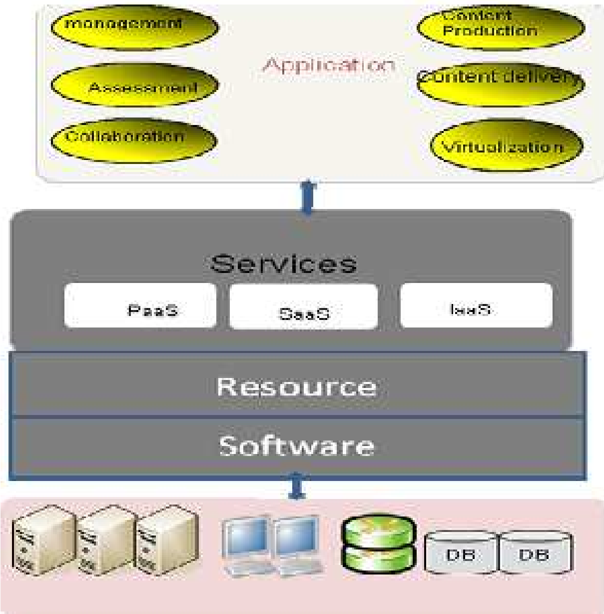

Fig. 4. E-learning Cloud Architecture

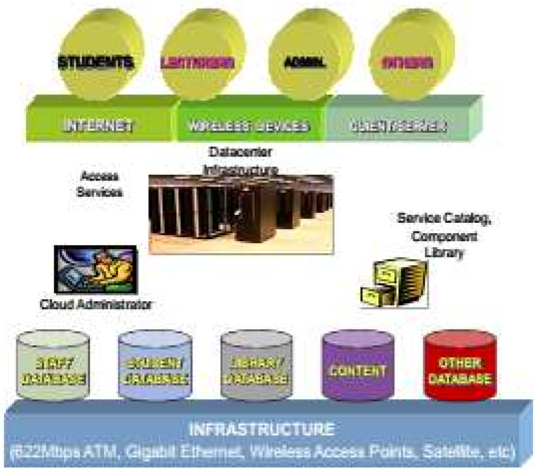

Fig. 5. Proposed Infrastructure Layer in an expandable view

The proposed e- learning cloud architecture can be divided into the following layers: Infrastructure layer as a dynamic and scalable physical host pool, software resource layer that offers a unified interface for e-learning developers, resource management layer that achieves loose coupling of software and hardware resources, service layer, containing three levels of services (software as a service, platform as a service and infrastructure as a service), application layer that provides with content production, content delivery, virtual laboratory, collaborative learning, assessment and management features.

A. Infrastructure layer is composed of information infrastructure and teaching resources. Information infrastructure contains Internet/Intranet, system software, information management system and some common software and hardware; teaching resources is accumulated mainly in traditional teaching model and distributed in different departments and domain. This layer is located in the lowest level of cloud service middleware, the basic computing power like physical memory, CPU, memory is provided by the layer.

Through the use of virtualization technology, physical server, storage and network form virtualization group for being called by upper software platform. The physical host pool is dynamic and scalable, new physical host can be added in order to enhance physical computing power for cloud middleware services. The following Fig. 5 depicts this in a clearer view.

B. Software resource layer mainly is composed by operating system and middleware. Through middleware technology, a variety of software resources are integrated to provide a unified interface for software developers, so they can easily develop a lot of applications based on software resources and embed them in the cloud, making them available for cloud computing users.

C. Resource management layer is the key to achieve loose coupling of software resources and hardware resources. Through integration of virtualization and cloud computing scheduling strategy, on-demand free flow and distribution of software over various hardware resources can be achieved.

D. Service layer has three levels of services namely, SaaS (Software as a service), Paas (Platform as a service) and IaaS (Infrastructure as a service). In SaaS, cloud computing service is provided to customers. As is different from traditional software, users use software via the Internet, not to need a one-time purchase for software and hardware, and not to need to maintain and upgrade, simply paying a monthly fee.

E. Application layer is the specific applications of integration the teaching resources in the cloud computing model, including interactive courses and sharing the teaching resources. The interactive programs are mainly for the teachers, according to the learners and teaching needs, taken full advantage of the underlying information resources after finishing made, and the course content as well as the progress may at any time adjust according to the feedback, and can be more effectiveness than traditional teaching. Sharing of teaching resources include teaching material resources, teaching information resources (such as digital libraries, information centers), as well as the full sharing of human resources. This layer mainly consists of content production, educational objectives, content delivery technology, assessment and management component [12].

VI. CONCLUSION

E-learning based on Cloud computing can be solved by means of cloud computing benefits: mass data storage, high speed computing capabilities, as well as its ideal allocation and the sharing mode of resources. Some problems such as platform security, technical standards, regulatory and other services are not well resolved yet in practice, pending further research and exploration.

However, e-learning based on cloud computing will not stop its pace to proceed. As the cloud computing technologies become more sophisticated and the applications of cloud computing become increasingly widespread, e-learning will certainly usher in a new era of Cloud computing.

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LITERATURE AND PAINTING ART CORRELATION BASED MODEL FOR E-LEARNING

G. Štasni[*], V. Makitan[**]

[*]University of Novi Sad/ Faculty of Philosophy, Novi Sad, Serbia
[**]University of Novi Sad/Technical Faculty "Mihajlo Pupin", Zrenjanin, Serbia
gordanastasni@yahoo.com, vesna@tfzr.uns.ac.rs

Abstract – Concerning innovation of literature teaching, this paper appoints at possibilities of correlation-integration system application that may be realized through e-learning. In the basis of the created learning material is the sunflower motive, which, in this model, has correlate status that connects two arts: literature and painting. Through information technologies this model may become more available to the pupils and enable the learning that is not conditioned by the place or time. At the same time model with this structure may be used for similar artistic contents, and on the other hand it may be stimulus for independent research work of pupils.

I. Introduction

Among other, literature teaching involves questions that determine literature as creative activity, as art. It is usual that literature definitions appoint at its means of expression that differ literature from other arts. In those terms, the literature is defined as an art whose basic mean of expression is word. In teaching, this problem may be seen concerning modern correlation-integration system that enables observing literature work in wider artistic paradigm. Having this in mind, it may be said that teaching procedure of connecting different arts is challenging and productive, firstly by separation of convenient theme and motive, which are different in their means of expression.

Functional permeating of teaching areas in the subject Serbian language and literature, as well as this subject and other arts, represents program requirement and at the same time it is a requirement of modern methodic. The goal of correlation-integration system is perception of

- Pupils learn at they own pace, and they can go through the study material as many time as they want;
- It is possible to chose own learning model (active or passive) and level of interaction: as classical written material by making own notes, interactive simulation, discussion with other pupils (e-mail, teleconferencing), more multimedia – graphics, animation, sound, etc;
- Practical work with different technologies – information about the teaching subject is not the only one available, but the additional knowledge and skills about using different technologies;
- Independent learning and interaction – teacher can also learn from pupils who independently seek for information sources. [3]

However, application of information technology in teaching should not be the only goal. IT in teaching may have real purpose if it may be used for phenomena specificities stressing that are dealt by pupils and teachers in learning-teaching process.

Information technologies enable teacher to prepare for teaching more precisely. On the other hand, the teacher is in a position to encourage pupils to do research work and to study as well, by valid and well prepared tasks he may guide them to seek and to get particular information, to understand, explain, report, discuss and debate about this information. Especially, it is important that the teacher encourages pupils to do information networking in coherent entity, and then use adopted knowledge creatively in specific workspaces. By meaningful usage of advantages that IT application in teaching brings, teaching process becomes more dynamic and interesting, without unnecessary verbosity in teaching. Pupils adopt new information more easily and have an active role in knowledge adoption, because this way of teaching develops attention and arouses interest, and enables pupils to remember learned materials longer.

Significantly important segment of IT application in modern teaching makes a wide field of possibilities to connect related subjects' areas. Namely, possibilities of sophistical methodic work will appoint teachers in related subjects' areas at teaching materials that may be correlated and in that way harmonized, both, during planning and preparing of teaching and during immediate work with pupils. [4]

This paper will show how elements of correlation-integration methodic system, with implementation of information technologies, at the example of two subjects – literature and painting art – may be applied. Moreover, it will be shown how the same motive may be achieved in different arts, by different means of expression, with the aim to discover its symbolic meaning and message. In this case motive of sunflower is chosen.

II. The Model

For clarification of abovementioned problem it is possible to start with a problem situation and asking a question such as: does a photograph with motive of sunflower in a vase or field of sunflowers represent a piece of art (Figure 1.)? Pupils, as participants in conversation, should use the strength of their arguments to confirm their own or reject opposite opinion. Namely, the real purpose of raising problem questions and tasks is in provoking pupils in expressing an opinion about particular part and its elements and confronting opinions, where everybody should stand for its own point of view and experience of piece. The pupil explains its own experience by giving answers to the questions that teacher or other pupil asks. During that discussion a pupil understands which attitudes should correct or instead of them to except other opinion as more convenient and argument. This type of task may be presented in social network which will enable more participants to include in discussion. It may start by asking a question and afterwards grow under influence of given opinions and comments of network users.


Figure 1. Sunflowers

Acceptable arguments are in the form of following statements, while subjective opinion may not be accepted as full argument, but only as a starting point of view:

- In the first place photographs have documentation role;
- Photographs arise by camera;
- Photography is making a picture by using the light;
- Photographs may be copied and every copy has the same value as the original;

- Photograph may have great influence on people and public opinion;
- Photograph represents individual way of reality interpretation by the photographer.

As synthesis of mentioned attitudes there is one more explanation for complex relation between photography and poetic image: poetic image differs from photography because it is a personal experience and not mechanical copy of life and world, it contains only distinct essentially details as opposed to all particulars, it is alive and dynamic and extracts only the deepest and the most important. Piece of art is condensed picture of life which gathers personal experience of an artist with deep objective meaning of life.

In the following symbolic of sunflowers at Van Gogh pictures will be reviled.

In August of 1888 Vincent Van Gogh started to paint series of paintings – *Sunflowers in a vase*. Those paintings symbolize lifecycle that is evoked by different tones of sunflower color – from fullness of life through transience to hint of death its self. “In that case he mostly used variation of blue and yellow colors that partly go into orange. Yellow and blue, broth to the extreme, have the role that blue and gold had in Byzantine art. But, while those colors in Byzantine art have unchanging, abstract value, in Van Gogh paintings they are concrete symbols of Earth, sky and sun, and even more symbols of inner rhythms.” [5]

As an aspect of preparatory research task pupils may be referred to the virtual visit of Van Gogh museum in Amsterdam (Holland) at official museum site (http://www.vangoghmuseum.nl/en). In that case they may learn more about life of Vincent Van Gogh and his pictorial work, to see his sunflowers in museum gallery, but also to actively use their knowledge of English.

Further, there is a preview of particular paintings from *Sunflowers* cycle (Table 1.) and their explanation that may be given in shape of information or questions, which will enable to the pupil to, based on color and element of composition, discover its symbolic meaning.

TABLE 1. PAINTINGS FROM SUNFLOWERS CYCLE

Three sunflowers in a vase 	**Model 1.** Three sunflowers in a vase, shiny green color, with turquoise background at brown basis, associate at earth and harmonically symbolize beauty of life. Only some wither leafs appoint at fragility and necessity of decadence. **Model 2.** How painter succeeded to have harmonious atmosphere at the painting *Three sunflowers in a vase*? By whose painting acts he symbolize beauty of life? By which picture elements hint about fragility and necessity of decadence?
Twelve sunflowers in a vase 	**Model 1.** Shiny and worm colors of sunflowers represent vital sun power. Shading from pale yellow to cinnabar ocher symbolizes fullness of life. Critics describe this painting as a symphony in yellow. **Model 2.** How the idea about fullness of life is realized at the *Twelve sunflowers in a vase* painting? Does number twelve have some symbolic meaning? Why critics describe this painting as symphony in yellow? What kind is the symbolism of yellow color?
Fourteenth sunflowers in a vase 	**Model 1.** The painting shows sunflowers in different phases of its decadence. Some flowers are open and live and other are despair as human heads. The painting symbolizes circle of life from birth to death. **Model 2.** By which shades, shift of moods and emotional coloration of painting *Fourteenth sunflowers in a vase* comparing to previous paintings of sunflowers is

	achieved? What revile flowers position in a vase?
A vase with fifteen sunflowers 	**Model 1.** There are shades of brown and yellow interlacing in the painting, which at the same time cause association about life and dying. **Model 2.** What association cause interlacing of shades of brown and yellow at the painting A vase with fifteen sunflowers?

Further, artistic beauty in the poem *Sunflowers* from Jovan Dučić will be reviled, and the beginning will be the basic principle of contrast at which the entire poem structure is based, and the idea and poem message goes from it. Dominant principle of contrasts permeates structure of entire poem and it achieves itself at different plans and by different means.

Pupils may independently revile elements by which this contrast it the poem is achieved. Considering that this principle is at structured and preliminary plan of the poem, this task requires theoretical knowledge. However, the fact that poem interpretation is based on individual experience that may be different from person to person may not be neglected.

In that way pupils confront opinion and gave argument for their problem solution at social network. After discussion, teacher may offer solution to the problem as a feedback. This step may be used as encouragement to further discussion about the subject.

TABLE 1. *SUNFLOWERS* FROM JOVAN DUČIĆ

U tužnom oku suncokreta, što nemo prati neba bludnje, tu su sve žeđi ovog sveta, sva nespokojstva i sve žudnje.	Contrast is in the first strophe among basic motives in the poem (sunflower and sky), and then in poetic atmosphere that poetic pictures create (*sad and silent eye of a sunflower and fiction of a sky*), and afterwards in poetic and symbolic content that fulfilling "sunflower eye" (*all the thirst, all the discomposure and all the last of this world*) directed to the sky content.
Šume u strahu svom od mraka: „Bog je pomalo sve što zari; I svetlosti je jedna zraka Mera i cena sviju stvari!"	Afterwards, the opposition deepens by making relation between darkness and light, feelings and meaning, which brings pictures of darkness and pictures of light; the same principle rules at the plan of making connection between poetic pictures: audio and visual (forests in their own fear from darkness); At symbolic plan of triads the God – lightness – life looks like it compares with Christian triune principle, in poet seeking for meaning and source of life.
„Sve je što živi na dnu tmine S prokletstvom nemim na svet palo – Sve što ne gleda u visine, I nije jednom zasjalo!..."	Although there are contrast interlacing in the poem and based on spacious relations (bottom and height) and light effects (darkness and glow), established relation has unique function: to explain basic thought of the poet: a last for unreachable and the sense and source of life (in some pictures this idea is more explicit).
S istoka kralji, obučeni U teško zlato, stoje plačni; I žreci sunca, naspram seni Prosjački vape u čas mračni.	The unique picture of sunflower (*s istoka kralji, žreci sunca – prosjački vape*) in which disturbing lyrics dominate, also lays at contrast painting of *kraljeva koji prosjački vape*.
Te tužne oči suncokreta U mom su srcu otvorene – Ali su sunca nakraj sveta, I tiho slaze mrak i sene Pomreće noćas širom vrti, Dvoredi sjajnih suncokreta, Ali će biti u toj smrti Sva žarka sunca ovog sveta.	Have the sad eyes of a sunflower found the sanctuary and meaning in a poets' heart – do they finally find suns in it, which are at the end of the world, it does not matter. Because the principle of the light and the sun over the darkness and shadows wins, as well as the principle of renewal and life will concur the principle of death, without denying its inevitability.

The next step may be defined as a problem question and be a cause for thinking and idea exchange at social network. Namely, the pupil should, at organization plan of the rhyme, discover metric parameters by which the basic idea in Dučić poem Sunflower is confirmed. The feedback should follow independent problem solving.

Feedback information:

By constant length of verses and almost narrative intonation the poet confirms the main idea in the poem. Arraying nine sibilates verses in the six four-verses strophe poem it is disturbed in the third strophe by combining nine sibilates with longer ten sibilates and shorter eight sibilates verse (9/10/9/8).

The final step is based on synthesis that may represent the individual act of a pupil, but it may be guided by teachers' suggestions, which should encourage the pupil to critical thinking. This activity can be realized at class as discussion which can be initiated by following sentences. The peace of art must have certain symbolic dimension, some message of universal, modern and general character, regardless on the way of expression, or mean of expression. In selected examples from different arts (painting and poetry) it is possible to make analogy that confirms the uniqueness of artistic idea and message, regardless to the mean of idea shaping. In that way the next analogies can be set:

- At formal plan – the series of paintings and cycle of poems;
- At content plan – unique subject and key motives;
- At symbolic plane – the motive symbolic (in the poem Sunflowers that belongs to the *Večernje pesme* cycle the motive of sunflower has the symbolic dimension, which represents seek for inevitable heights and spaces (sky), as well as for ideals and light motive as source of life).

Explanation of pieces of art may be finished with a problem question: why sunflower was chosen for symbolization of these ideas. At this question the answer could be that its title contains the basic connection with the sun – how the sun goes over the sky, and the flowering head of the sunflower follows it, which lit by the sunlight, shines like a gold. When the sun sets, the sunflower looks down to the ground. The night is the time when the sunflower rests, the lack of light, the lack of life. In that way the key opposition connection: life – death is created on symbolic plan.

Speaking about symbolic dimension in general, there is a question referring relation of a piece of art and objective reality. This problem is contained within term of artistic truth. Moreover, in [6] it is stated that "literature is part of everyday life and like that it speaks about the same thing as every human effort for contemplating reality. The only difference is that literature piece of art about life explains as art and art only, in the manner of the shaping world of arts especially".

III. Conclusion

Methodical approach to teaching material which is based on modern methodical systems such as correlation-integration system with elements of problem teaching, realized by IT elements, demands detailed preparation of a teacher including appropriate subject for this type of methodical modeling. Also, it includes exploring of reliable and well informed e-sources for their research work, as well as special structuring of teaching material in accordance with e-media. Concerning interdisciplinary approach to selected subject, team work is required and it includes teachers with different educational experience. This mostly enables reliability of learning material and creative creating of teaching material.

Acknowledgment

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E-LEARNING AS A NEW METHOD FOR EDUCATION

O. Iskrenović-Momčilović, B. Miljković
Faculty of Education, Sombor, Serbia
oljkaisk@yahoo.com

Abstract - The development of information and communication technology and constantly innovating educational condition changes the methods and forms of teaching to become an optimal and efficient in the era of mass application of Internet and electronic sources of knowledge. Distance learning is increasingly used in order to facilitate the activity of students for qualitative evaluation of knowledge and progress of students according to individual abilities and prior knowledge. In this paper the main characteristics, advantages and disadvantages, possibilities and uses of distance learning are analyzed.

I. INTRODUCTION

Distance education has a history that spans almost two centuries, and this time periodrepresents significant changes in how learning occurs and is communicated. [6] It appeared in the mid 18th century in England, when they began to work part time school. Students are sent to professors made tests and assignments by courier. In 1912. inhabitants settled in the rural areas of the United States were able to educate themselves through radio courses at the University of Iowa. Long tradition of distance learning are Australia, Canada and New Zealand. This method of acquiring knowledge now used by a growing number of students around the world.

Distance learning involves learning, which does not require the physical presence of students and teachers in a particular place. This means that they are spatially, and sometimes time, away from each other. These two distances can be successfully overcome by using modern information and communication technologies. With that in mind, education is organized at all levels, from elementary school through high school to college. In this way, distance learning has found wide application in education, especially in developed countries. Its advantages over the traditional method of education provided him a secure future in many educational systems around the world.

Development of distance learning (Fig.1) has reached a significant level in the world. Number of users and the number of people interested in this form of education is increasing dramatically from year to year. In addition to primary and secondary school, a lot of interest shown by the students, then a young private entrepreneurs, but more and older people. The only requirement that distance learning sets the users is computer literacy and Internet use. Today, it is unthinkable that someone does not have these skills.

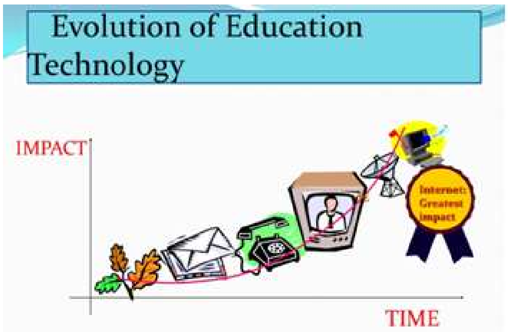

Figure 1. Evolution of education technology

On the other hand, a large number of world-renowned, educational institutions offers and apply this modern model of education. Research results show that in Serbia there is an interest and need for organization-education distance learning or a combination of the traditional form of education. However, it is still slow to realize.

II. FORMS OF DISTANCE LEARNING

Figure 2. Distance learning

The most prevalent forms of distance learning (Fig. 2) are [1]:

- e-mail
- web

- videoconferencing
- virtual classroom

E-mail is the oldest and one of the most widely used Internet service, which is used for the exchange of electronic messages between users or user groups. These are private messages that can be exchanged with other Internet users regardless of their place in the world where they are located. Messages are delivered instantly, when they sent. The user can read them when it comes to features and contents, with the possibility of permanent preservation.

Web is the best available and most frequently used method of presentation of teaching content. It allows a virtual (electronic) shop window, so site exposed to many pages of information and data, which can contain text, images, sound, animation, etc.. Web pages can be continuously changed in order to have a better view of the content. Their most important feature is that it can be visited by multiple users at the same time, or they may be wholly or partially restricted access.

Videoconferencing is the transmission of images and sound in real-time between the two locations. It is a technology that allows two or more people in different locations to see or hear each other at the same time freely communicate as if they were in the same location. Sound and picture are transmitted simultaneously electronically in a digital format, which provides simultaneous interactive communication. Video conference is mostly used for business purposes and in distance learning. In the field of education are suitable for all levels. Students and professors quickly and efficiently discuss and share a necessary data to learn the material.

Virtual classrooms are based on the model of collaborative learning and the use of Web technologies and enable an open type of learning, which is available to all participants in education regardless of their personal characteristics. They are located in a teaching environment information and communication systems. Their main goal is to enable students to the contemporary and effective way to get new knowledge. Students and teachers participate in the classes, which are spaced from one another and separated. Students are placed in the concrete got this classroom, so to get an impression of work in terms of traditional education.

There are two modes of distance learning:

- synchronous - classes take place in real time (video, chat, e-mail)
- asynchronous - does not require the simultaneous participation of students and teachers, which means that students themselves can choose when to adopt the syllabus.

Distance learning is undoubtedly the best way of improving teaching. It uses modern information and communication technology as a basis for implementation. Computers (Fig.2) represent a multimedia tool that allows interactivity and learning at their own pace. They increase the likelihood of an individual to access to educational institutions via the Internet. Computers can be used to present individual lessons or organize instruction and track student progress based on the results achieved [2]. They greatly facilitate communication between students and professors. Today, on the Internet there are a number of literatures in the form of various guidelines for the use of various computer applications. On the other hand, computers and computer applications are subject to constant innovation, and the need to constantly monitor and apply in practice. Distance learning is a set of challenges and requires time and investment.

III. PARTICIPANTS IN DISTANCE LEARNING

Organizers of distance learning are educational and scientific institutions, such as online universities who carry out the education of its students. Can involve a variety of companies that organize training for their employees. Novelty is certainly the fact that this type of education can develop even individuals such as various consultants and associates.

The participants of distance learning are students and teachers. It should be emphasized that in addition to regular students present:

- adults, so-called. nontraditional students,
- employees not able to attend a classical education,
- people who require more activity and interaction in learning,
- persons with physical disabilities or disorders,
- people geographically distant from teaching centers.

Finally, the successful implementation of distance learning is necessary and those who create and distribute learning materials, and various administrators, who take care of the technology implementation.

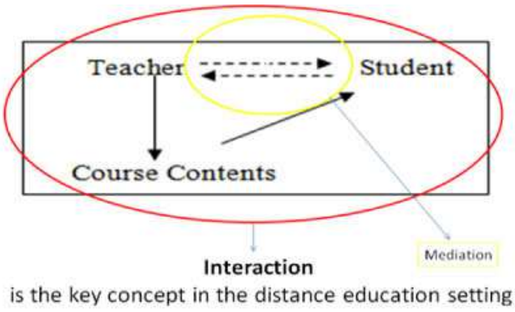

Figure 3. Interaction of student - teacher

The conditions necessary for a **student** to be an active participant of distance learning are: access to the Internet, owning a computer and basic computer literacy. It should be noted that are of great importance and motivation, perseverance, discipline, organization, commitment, consistency and interactivity. At the beginning of the student familiar with the program and methods of work, then I decide on the time and pace of work. The most important is the interaction between students and teachers (Fig. 3), but the important interaction between the students themselves. Students should ask each other questions in order to better mastering the curriculum.

Distance education to decide and adults, who for some reason are not educated in the traditional way, but those who want to invest in themselves, acquire new knowledge and skills, adopting the concept of lifelong learning (for personal or professional reasons). [2] The awareness that every 5-8 years total fund of knowledge doubles existing knowledge obsolete, unstable labor market imposes monitoring trends and competition - requires timely response.

Teacher faces particular challenges within distance education. He is asking for specific didactic and methodological qualifications. Comprehensive work involves customizing manuals, textbooks and courseware computer technology. The teacher is responsible for the preparation and selection of instructional materials and tests knowledge relating to checks, and all other activities necessary for the acquisition of knowledge, skills, and skills of students. He adapts his teaching to the needs and the expectations of students, who have little direct a great computing experience. Additional teacher encourages students to use new information and communication technologies. It should be the right time to respond to every need or problem the student to enhance their motivisnost. On the other hand, what a thankless job it is to monitor the progress of each student and valued their knowledge. It is recommended that one teacher works with most 15 - 25 students (depending on the level of education).

Administrators are essential in the planning and implementation of distance learning. They are the decision makers and reviewers, open and maintain students' and teachers' accounts, joined students and teachers groups worry that an education program to function normally. When distance learning establishment, administrators are responsible for the technical maintenance of the system. They enable the application of the latest information and communication resources, which helps technical personnel. To a program of distance learning has developed the necessary three years, and that such a program would cost it takes at least eight years.

Technical staff has the function of services to support students to sign, duplication and distribution of materials, ordering textbooks, process evaluation reports and more. Every day they are available, which make the learning process easier.

IV. ADVANTAGES OF DISTANCE LEARNING

Today's distance learning has become a leading method of education in the world, thanks to the breakneck development of information and communication technologies. It has a number of advantages over traditional learning (Fig. 4). For all that this form of education is becoming widely accepted by educational institutions and by individual students.

Figure 4. Traditional and distance learning

The basic advantage of distance learning is to reduce the space and time constraints. Neither the student nor teacher does not have to be physically present in the educational institution in which the teaching. In this way we do not waste time on the way to an educational institution and back to the house, reducing costs of transport and accommodation during the education. It should be noted that while non-renewable resource, and it is necessary to be proficient in its management. All this gives the student the following features [3]:

- studying outside their place of residence, and even the country's borders, and that does not reside in educational institutions, thereby reducing the cost of education,
- to work during the study regardless of the venue of the study,
- to attend classes in the case of permanent or temporary physical problems, disability or illness
- choose a place of learning, depending on the media used to distribute learning materials (learning on the job, at home ...)

However, all this has contributed to student-teacher contact is no longer intimate, because there is no face to face interaction.

In traditional learning, lesson is timed at 45 minutes. Depending on the subject, represented by one hour or more hours per week. In distance education, now lasts as long as the weather suits the student. Of course, different time intervals between classes, which is the traditional education 15 minutes, and in distance education a student chooses how it will last. Now the student can:

- choose learning time (high motivation, time planning, and the ability to analyze and synthesize the content being taught)
- to learn throughout life (lifelong learning)
- to learn at their own pace - through the learning material to pass as fast and as many times as you want.

Distance learning is focused on gathering information and the learning. [4] This saves time and draws an unlimited source of information. The difference between traditional and distance learning lies in the organization of various examination as well as the grading. Distance learning provides an opportunity for:

- selection of the desired program of distance education, offering educational and business institutions outside the places where people live or work
- participation on the best and most prestigious lectures of famous experts of educational institutions without change of residence
- choose their ways of learning - active or passive learning, with different levels of interaction: conduct their own notes, interactive simulations, discussions with other students, the use of multimedia
- practical work with different technologies - thereby acquire not only information about what is taught, but also additional knowledge and skills on the use of various technologies.

V. DISADVANTAGES OF DISTANCE LEARNING

Distance learning is an effective way to improve and enhance the educational process. It is an effective basis for new and better ways of managing knowledge. Intensive introduction of information and communication technology in education has become a priority for modern educational institutions around the world. Efficiency of distance education reduced its shortcomings. However, emphasize that they are not able to influence the further development of this method of education and its further expansion.

The biggest challenge or problem in distance learning is that it is difficult to persuade the students to enroll in the online course or program, actively participate in its execution and successfully complete it. Distance learning depends on information and communication technologies, so too is making very educational content. Not everyone is able to have adequate computers and be familiar enough way to work on the computers. Adversely affect the students can work stoppages and malfunctions of the computer. It should be borne in mind that the Internet is not an ideal choice for work, because problems can make viruses and hacker intrusions.

Many forms of distance education fail, because a large number of students give up and never ends begun. In the early stage of development, the degree of withdrawal of students was even higher than 60% and is now much less. The most common reasons for dropout students are:

- lack of social contacts among the participants, because individuals are not accustomed to such isolation
- the participants are not expected to join the right group, i.e. to come to an educational institution, where they are waiting for other students and the teacher, but they do mostly from home or from work

- low self-discipline and motivation to conscientiously perform their duties, as participants generally overworked and overburdened numerous other commitments
- lack of live contact with the professor and other students causes a feeling of loneliness and isolation, which certainly reduces the motivation and concentration

Because of these shortcomings, in this type of education, it is necessary to pay special attention to students' motivation to self-assess their need for learning. In addition, you should hire teachers and mentors, who will monitor their progress, constantly provide support and assistance in learning and encourage them to carry out their tasks.

Distance learning is often based on textual manuals with few graphics. Such facilities are participants usually tedious and boring to read. Therefore, special attention should be paid to the design and development of interactive and multimedia learning, which will be able to maintain the student's attention and show him the material in an interesting way. It imposes a greater burden on teachers to prepare teaching materials, because it is necessary to invest twice as much time than with traditional education.

VI. CONCLUSION

The society in which we live has become computer literate. In such an environment constantly growing need for lifelong learning. Changed conditions of life are caused changing conditions of learning and education. Distance learning is a new way of acquiring knowledge. By the end of the nineties, a platform for the development of distance education were few and unattractive to a wider audience. However, the rapid development of Web technology and the growth of Internet use, they have flooded the market and now represent a significant pillar in global education.

Over time, they changed the means of distribution, transmission channels, instructional materials and facilities. Today, distance education is becoming increasingly popular in the world. His numerous forms of help overcome spatial distance students and teachers. Distance learning is becoming a powerful tool to improve education. Due to their high speed and development, their future in education is almost assured.

In our distance education is underdeveloped because it uses a small educational institutions. So do not threaten an epidemic of distance education, but we must be prepared for the challenge. However, despite its benefits, the question is just how much this kind of education is good, given the many opportunities for fraud. This issue in particular needs to be set in Serbia, where the mentality of people different than in Western Europe and America. Particular attention should be paid to the analysis of this type of education affects to creation anti-sociability and a sense of isolation among our people. Also, it is necessary to examine more to the benefits of distance education in our advantage in the optimal way.

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A* ALGORITHM FOR E-LEARNING

M. Živković, V. Ognjenović, I.Berković
University of Novi Sad, Technical Faculty Mihajlo Pupin, Zrenjanin, Republic of Serbia
meelosh.me@gmail.com, visnjao@tfzr.uns.ac.rs

Abstract - This work presents the A* search algorithm. The analysis is given based on the historical development of heuristic search algorithms. There are multiple heuristic methods that can be used within A* search algorithm. The implementation is given within the application written in HTML, CSS and JavaScript languages. It is shown that the application can be used for e learning.

I. INTRODUCTION

Representing a problem by a State Space in Artificial Intelligence is actually abstracting the problem and representing it with a graph. The graph nodes represent the states in this case, and its edges are the actions (operations) of transforming one state into another. The goals, one or more, are also represented by the graph nodes. The path from the initial to the terminal node is called the solving path. Trying to solve the problem by random wandering through the State Space does not have a solid effect in finding the solution path. It is necessary to introduce a certain order in the search. According to [1], the main goals of introducing a control search strategy are:

- Narrowing the state space search,
- Directing the search towards the perspective solutions.

Choosing a control strategy is significantly influenced by our knowledge of the domain of the problem we are trying to solve. The following extreme possibilities are characteristic: the absence of any knowledge of the problem domain, or complete knowledge of the problem domain.

According to [1], the majority of tasks to solve within the area of artificial intelligence is somewhere between the described extremes. Exploring the properties of the problem domain leads to certain, but incomplete knowledge, on basis of which it is possible to make more or less efficient control strategies of heuristic search.

If we mark the function giving the price of traverse from node n_i to node n_j with $c(n_i, n_j)$, the problem can be represented as finding the minimum price solving path.

II. A* ALGORITHM

A* algorithm was developed as the upgrade of the famous algorithm invented by the mathematician Edsger Dijkstra. It was first described in 1968 by Peter Hart, Nils Nilsson and Bertram Raphael of Stanford Research Institute [2].

A. *Estimated function*

A* algorithm is based on the evaluation function of the following form:

$$f(n)=g(n)+h(n)$$

where the function g(n) is the value of price from the initial node to node n. The function h(n) is the heuristic estimation of minimal path price from node n to a certain terminal node.

The search starts from the initial node and continues with choosing the nodes with the minimal value of function f at each node, from the list of available nodes.

If the function h(s) is ideally chosen, then the increase of the function g(n)'s value is equal to the decrease of the function h(n)'s value along the optimal way. Therefore, the value of f(n) is constant [1].

The secret to its success is that it combines the pieces of information that Dijkstra's algorithm uses (favoring vertices that are close to the starting point) *and* information that Greedy Best-First-Search uses (favoring vertices that are close to the goal).

B. *Heuristics for grid maps*

On a grid, there are following heuristic functions [2]:

- On a square grid, that allows 4 directions of movement, use Manhattan distance (L_1).

$$d_{Manhattan} = |x_1 - x_2| + |y_1 - y_2|$$

- On a square grid that allows 8 directions of movement, use Diagonal distance (L_∞).

$$d_{Euclidean} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$d_{Chebyshev} = \max(|x_2 - x_1| , |y_2 - y_1|)$$

- On a square grid that allows “squeezing through” obstacles use Diagonal Free distance [3].

III. Implementation

The implementation was done in form of a web application, where HTML and CSS were used for styling and JavaScript was used for interactivity and implementation of the actual algorithm (Figure 1, Figure 2).

Figure 1. A* algorithm – A* Path Finder

Figure 2. A* algorithm – A* Path Finder

In the sidebar of the application (Figure 3), the user can specify his own preferences that apply to path finding and its graphical interpretation.

Figure 3. A* Path Finder - Sidebar

The following preferences are available:

A. *World Options*

1) *New World*

New World: re-creates the world and randomly places nodes (Figure 4).

Figure 4. A* Path Finder – New World

2) *Redraw World*

Redraw World: re-draws the world and re-animates the character (Figure 5).

Figure 5. A* Path Finder – Redraw World

3) *Show Borders*

Show Borders: Toggles borders around each node for easy tracking (Figure 6).

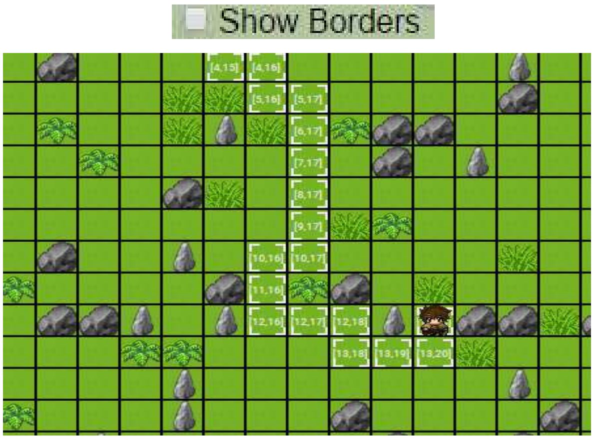

Figure 6. A* Path Finder – Show Borders

B. *Distance Function*

In the drop-down menu (Figure 7), the user can specify which function the algorithm is going to use. The following functions are available:

- Manhattan
- Euclidean
- Euclidean Free [3]
- Chebyshev
- Chebyshev Free [3]

Figure 7. A* Path Finder – Distance Function

C. *Log*

The log registers user's interaction with the grid map and logs coordinates of each node when the search starts (Figure 8).

Figure 8. A* Path Finder – Log

IV. POSSIBILITIES OF USING THE APPLICATION FOR E-LEARNING

This application can be found on the following address:

https://miloszivkovic1.github.io/astar-js/

The Instructions panel and the log contain the information the students can use for e learning, since they can choose a distance function and follow execution of the algorithm.

The source code of the application can be found on the following address:

https://github.com/miloszivkovic1/astar-js

Using the application, students can easily spot the important characteristics of A* algorithm. They can also compare heuristics and visually monitor results of algorithm execution.For further studying of this algorithm, students can analyze the code and edit it.It is planned that this application takes part as the start of student projects in graph search algorithms field of study.

V. CONCLUSION

This work has shown the ability of working with A* algorithm. Multiple heuristics were shown that calculate the shortest distance between two nodes. Aside from analysis, application "A* Path Finder" was presented. Within in, many important elements were implemented, such as the heuristic method chooser, the log and the World option.

It is shown that the application can be used for e learning.

For further development, it would be useful to implement a functionality that can enable user track multiple distance functions simultaneously.

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EDUCATION MANAGEMENT

APPLICATION TROUBLESHOOTING OF STORAGE AND MANAGEMENT OF WATER RESOURCES

A. Krstev, K. Runcev
University of Goce Delcev – Shtip, Republic of Macedonia
aleksandar.krstev@ugd.edu.mk, kostadin_runcev@yahoo.com

Abstract - Implementation of new application software systems to modernize the control of water resources represents one of the most cost effective solution to access data related to leads. The detailed processing of the data analysis can be improved and the water monitoring. The need for detailed monitoring, supervision of water resources, access to application field, would serve in the work of state and municipal institutions. That information system for water resources management (ITWR) offers all this. With the help of software analysis using methods statistically analyzed water bodies, all data have been entered in the database from which the calculated water consumption and utilization of water resources. With the help of computer information system for water management and water resources would enable an easier way to access, exchange and access to information. Timely access to data, monitoring of water levels and the prevention of natural disasters represent an incentive for the creation of a large database in which to store all relevant information and data related to water. The database and its connection with new computer systems and applications can easily provide timely access to data and saving money.

I. INTRODUCTION

With the development of technology and the use of new methodologies for data exchange, there is the need to use a system whose assistance would allow easier access, use and download the information (data).
This project will be explained the information system used to manage water resources (ITWR).

What is the need of using such IT system?
The utilization of water resources and water is a daily basis, both in households at work, in school faculty. Growing water demand represents an additional incentive for the creation of an information system that would oversee current state of water resources.

A. The use of water resources in Macedonia

Macedonia has a huge potential for the proper and efficient use of water resources, environmental protection and thus improve the living way in the country. By applying new methods and systems already in use in countries around the world could improve the current situation which is not encouraging. Large challenges offered water area and water resources constitute an incentive for all municipalities and centers that are part of this country as well as a number of professional teams working in this area.

All municipal centers in this country receive greater responsibilities and greater powers for monitoring and analyzing water potentials and resources. This represents a great opportunity for the implementation of new projects in the water and faster implementation of activities related to the environment and its pollution.

By following the world standards and criteria, Macedonia can save a lot of water resources and water especially in summer dry periods when browsing the water is much higher than a search, which all users would have to lower costs in terms of consumption and utilization.

Restoration of water resources and their use is also one of the key processes that would improve the life cycle in this country. Of course, there are and other sources of energy associated with water, which should be further examined and analyzed. By using modern application systems improves the current state of water resources and the control and exploitation of the waters.

B. Water and water resources in Macedonia

Implementation of new application software systems to modernize the control of water resources represents one of the most cost effective solution to access data related to leads. The detailed processing of the data analysis can be improved and the water monitoring. The need for detailed monitoring, supervision of water resources, access to application field, would serve in the work of state and municipal institutions. That information system for water resources management (ITWR) offers all this.

The emergence of a large number of expenses that occur during data collection, their approach is necessary to find a solution that would be viable for a longer period of time. The goal is to implement an information system that would be received detailed, timely and accurate results for a more efficient operation and proper utilization of water resources.

Implementation of the Information system for managing water resources based on the following objectives:

- Providing accurate field data;
- Reducing the time period for receiving data;
- Database that will enable easy and timely access to data;
- Greater protection of data;
- Identification of data access;
- Video surveillance of critical points of water bodies and artificial reservoirs;
- Using applications for download, typing and data recovery in fieldwork;
- Saving time, financial resources and easy distribution of data across the country.

With the help of software analysis using statistical methods are analyzed bodies in Macedonia, all data have been entered in the database from which the calculated water consumption and utilization of water resources.

Rivers which are mostly used as bodies in this state will be divided into several parts in order to make them more detailed analysis. Water bodies are not fully utilized in all parts of identifying areas so with this statistical analysis are getting more and more reliable data.

C. Objectives of the project

Timely and correct implementation of the information system for water resources management (ITWR) need to set goals to be realized the specified time period. The objectives of this project are shown in the next section.

1) Preparation Phase
In the initial phase of the study are presented data that will be used to display the current field situation and the need for a system that this job would be simpler. It is this data analysis and statistical analysis would show or model that would be easy to use and will monitor very big deal.
2) Maintenance of documentation and data
By analyzing the data received documentation that could be quite important for the institutions of this country. This documentation contains all the documents required to create a huge database, and the creation of an information system.

3) Creation of an information system for water resources management
With the help of computer information system for water management and water resources would enable an easier way to access, exchange and access to information. Timely access to data, monitoring of water levels and the prevention of natural disasters represent an incentive for the creation of a large database in which to store all relevant information and data related to water. The database and its connection with new computer systems and applications can easily provide timely access to data and saving money.

Why monitoring water using a computer system?
Need water every day is greater. This is not only water that is used in everyday use (households, schools, state institutions, etc.). Using the detected position in the distribution of water can easily find the problem and eliminate the lower interval if using applications related to computer systems. Also with the help of mobile phones can be controlled distribution of water for irrigation. Conserving water in dry periods and implementation of drip irrigation system is an additional incentive for the application of this kind of coordination and control of data.

Locations in the country with specific access and difficult accessibility

Certain locations in the country (Macedonia) would certainly preached difficult problem of providing access to the database and the utilization of information system online. Yet in much of the whole territory is available for monitoring and timely upload of data from the spot. The locations of which can be difficult to obtain online data will also be part of the monitoring but attaching data will be achieved by any other method.

D. Implementation of the system

The stages of project implementation using the information system for the control of water resources are as follows:

- Collecting data - gathering data from all state institutions and municipal addition to database;
- Amendment and verification of the database - The collection of all data related to water and water resources on the territory of the whole state, monitors the process of amending the database;

- Maintenance of data and their recovery - All data will be collected from different institutions which are registered in the database need to be sustainable, available and applicable. The data obtained from monitoring on the ground must be entered which means that you have to run the data recovery;
- Computer system for management of water resources - By defining the database can be started by connecting the computer system and all state institutions that need information. The need for data can be provided online, with exactly this system and all the information of the activities from the field can be inserted from the spot.

The use of new technologies in the IT sector contributes to:
1. Lower consumption of finance and time, going from institution to institution, writing letters, waiting for requests etc;
2. Increased efficiency of data obtained from the scene, their greater probability and write properly in base and their power for immediate modification (change);
3. Rational use of water and equitable distribution of water;
4. Enhanced lifespan and timely information to citizens in the field of water;
5. Controlling and monitoring the irrigation system, release of accumulations control monitoring points by placing a video monitor and easy timely intervention;
6. Timely detection of problems in the operation of the system;
7. Use of different technologies and systems for saving water resources and spill and accumulations.
8. Education and learning farmers using new systems for the collection and control of the water resources.

II. Proposal for Preservation Program Based on Data

SPSS 19 software package offers many possibilities for data processing, their analysis, comparison, display and preservation. In this part of the project will be displayed appearance of SPSS 19 and all its features.

The look of the SPSS 19 e shown in the following figure:

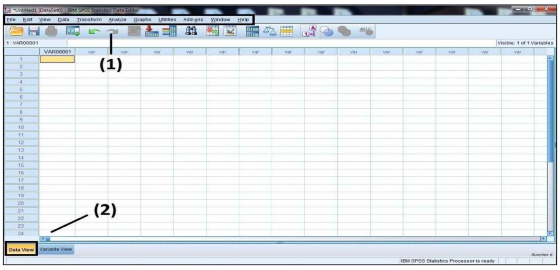

Figure 1. SPSS 19 display the main menu

The picture number 1 shows the main menu of the SPSS 19, while the number 2 is designated Data View. The main menu consists of several submenus as follows:

- File menu - menu with two data we able to create SPSS File (document), the possibility of opening a document reading variables from the database and their display, reading and display the ASCII data file, saving, printing the output of processing data and save them (save);
- Edit menu - Cut (move data), Copy (copy), Paste (insert), Modify (change data), Copy Charts (copying diagrams);
- View menu - Turn off tools (toolbars), display tools and their use (or not included) controlling the values embedded in the table;
- Data menu - In this menu you can change the data copied and to change their characteristics, values, sizes, also arranged classes and variables, using and define the methods of analysis;
- Transform menu - menu offers us an opportunity to change the data and the variables that we have selected, a window display with date and time, use the clock cycle of the data (series);
- Analyze menu - Data analysis is one of the biggest features of SPSS 19. Therefor this menu offers that option. The menu offers the following options: cross tabulation, forecasting, analysis of variance, correlation, linear regression, factor analysis;
- Graphs menu - SPSS 19 offers the option to display the possible solution as an image (graphic). Using the chart as the output display resolution the user can detect and perceive the difference and comparison of data. Here we are offered several types of charts that can be used as follows: bar charts, pie graphs, histograms, scatterplots, full-color and high-resolution graphs;

- Utilities menu - Display of information and variables are processed, control variables and all the windows used for the analysis, change of syntax;
- Add-ons menu - Review of what is used in the analysis of data;
- Window menu - Minimizing windows and their use and
- Help menu - Help menu of the SPSS19th users.

In the Data View are entered variables are analyzed and processed. Except field data view, there is another option for consideration of the detailed characteristics of the data that would be imported. In this field are given all the commands needed to use the data and processing.

Data can be of different types and have different sizes or other display output. Option to display variables (variable view) is shown in the figure below.

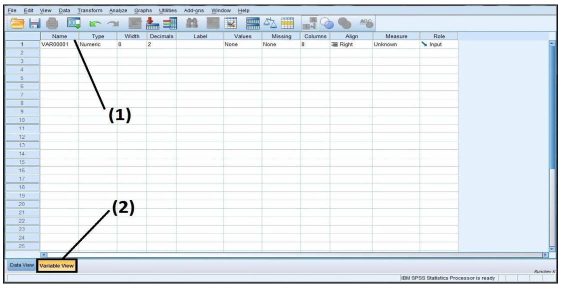

Figure 2. SPSS19 assignment of variables and their features

- Name - This column can change the name of the variable. Example (Macedonia 1). The name can contain special characters such as /, *, and $. The data should not be launched with a number. Otherwise if you want to enter the number as initial value, we receive information that is not possible;
- Type - Defining the type of data that is entered in the column. What type of characters used (strings, characters, numbers). It determines what type of data is analyzed and processed;
- Width - Change the number of digits that can be displayed in the column;
- Decimals - let's change the decimal places of any numerical data. Define how many decimals may appear in column number, thereby defining and the accuracy of the data and its expression;
- Label - A detailed description of the data and explaining their characteristics. They can be given commands us to explain that such data and what significance they have;
- Values - Explanation of data with text. All data set number can be defined by text;
- Missing - Define the type of data that should be missing (not shown in figure) of output;
- Columns - The width of the column to display the list of data can be set using the control columns;
- Aligin – Correspondence of data (text or numbers) and
- Measure - Determining the type of data processing.

A. Displaying Database (attribute table)

Name	R Basin	Length	Geology	IT	Type	City	Monitoring	Video	GIS
Albuna	Amazon	500	1	101	1	8	14	No	R1111
RioNegro	Amazon	440	2	102	1	7	12	No	R1112
Beni	Amazon	110	3	104	1	5	6	No	R1114
Orton	Amazon	122	3	105	1	5	11	No	R1116
Sena	Amazon	235	4	107	1	3	5	No	R1117
SanMartin	Amazon	342	1	108	1	2	5	No	R1118
RioGrande	Amazon	78	2	110	1	1	2	No	R1120
SanMateo	LaPlataa	122	3	201	1	5	5	No	R1121
Vibora	LaPlataa	66	3	202	1	4	4	No	R1122
Matoss	LaPlataa	87	1	204	1	1	4	No	R1124
Kamacho	Bocca	223	2	301	1	4	3	No	R1125
Yura	Bocca	321	2	302	1	2	3	No	R1126
Fortuna	Bocca	39	2	304	1	2	1	No	R1128

Figure 3. attribute table rivers of geographical database

In this part of the project shows the geographic database of rivers in Macedonia. The attribute table can be supplemented and amended. The data used in the table are the following:

1) Name - This field stores the name of the water body in this case - the name of the river.

2) River Basin - a field in which is stored the river basin which belongs to that river. In the example used the following river basins: the Amazon, La Plata and Boca.

3) Length - The length of each river is shown in this field (in kilometers).

4) Geology - Geology of each water body numbered according to the type of water body (channels have a body type 0 - no geology in them).

5) IT - code database, the rivers are indicated with 100, 200 lakes etc.

6) WB Type - This section splits the water bodies. 1 used rivers 2 used lakes and 3 are used for irrigation canals.

7) City - The total number of cities through which the water body is shown in this column.

8) Monitoring - All monitoring stations set up on water bodies and their sum is stored in the circuits of geo base.

9) Video - The need for video surveillance is required so there is an option for its use.

10) GIS - Code that is used to distinguish the geology of the bodies. Ex R1127 was used as a source of a river, L1130 was used as a source of Lake CH1143 used as a code channel irrigation.

All these explanations also apply to databases of lakes and canals irrigation to be displayed in the next few pages. Of course the database is defined with those attributes but will further complements.

Name	R Basin	Length	Geology	IT	Type	City	Monitoring	Video	GIS
Pypo	Altipano	100	4	402	2	2	2	No	L1129
Salar	Huanhu	221	4	403	2	2	1	No	L1130
Uruu	Huanhu	214	3	404	2	1	2	No	L1131
Rogya	Huanhu	115	3	405	2	1	2	No	L1132
Guachacha	Huanhu	100	2	406	2	2	1	No	L1133
Huandida	Yurica	54	2	407	2	1	3	No	L1134
El Okeano	Yurica	44	1	408	2	1	3	No	L1135
De Cansa	Doco	34	1	409	2	3	2	No	L1136
Luangy	Doco	77	2	410	2	3	2	No	L1137

Figure 4 . Attribute Table for ponds from a geographical database

Name	R Basin	Length	Geology	IT	Type	City	Monitoring	Video	GIS
Santa Cruz	Amazon	6	0	501	3	3	2	No	L1129
La Paz	Amazon	3	0	502	3	4	2	No	L1130
Sugre	La Plata	3	0	503	3	2	2	No	L1131
Jaguba	La Plata	3	0	504	3	2	2	No	L1132
Rio Gio	Boca	2	0	505	3	1	2	No	L1133

Figure 5. Attribute Table for irrigation channels from a geographical database

III. CONCLUSION

The need for detailed monitoring, supervision of water resources, access to application field, would serve in the work of state and municipal institutions. That information system for water resources management (ITWR) offers all this. With the help of software analysis using methods statistically analyzed water bodies, all data have been entered in the database from which the calculated water consumption and utilization of water resources. With the help of computer information system for water management and water resources would enable an easier way to access, exchange and access to information. Timely access to data, monitoring of water levels and the prevention of natural disasters represent an incentive for the creation of a large database in which to store all relevant information and data related to water.

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TACIT KNOWLEDGE TRANSFER IN EDUCATION

M. Zakin, S. Stanisavljev, N. Petrov, O. Paunović, U. Marčeta
University of Novi Sad, Technical faculty „Mihajlo Pupin" Zrenjanin, Republic of Serbia
milazakin@gmail.com

Abstract - This work will focus on the study of the creation of quality knowledge through the e-Learning environment and the conceptual understanding of the interdependence of learning and social context to advance and improve student learning. In this paper, emphasis is placed on the importance of knowledge management in education. The focus is placed on the management of tacit knowledge, because it is presented as knowledge that creates the attitude of students towards education and their further application in the work.

I. INTRODUCTION

This literature will be further reviewed in the subsequent, knowledge management in e-learning and e-learning outcomes sections. A knowledge management process which is a value chain of activities that generate (create and acquire) knowledge, represent (codify and store) and make it accessible so that it can be utilised or transferred [3]. A major goal in successful knowledge management in education is to improve student learning [23]. Educational institutions are under tremendous pressure for increased accountability from external and internal sources. External pressures raised by stakeholders like employers, government agencies, and parents for measurable improvements in educational institutions are mounting and demand for information about student learning outcomes is escalating.

Internally, educational institutions are asking themselves difficult questions about accountability: for example, how can we improve student learning outcomes? In this climate of external and internal demands for accountability and improvements of student learning outcomes, schools, colleges, and universities as organizations committed to educational missions, must ensure students are learning by acquiring knowledge in the most efficient and effective way. Institutions must also have the ability to demonstrate enhancement of student learning and development. Thus, educational institutions may find it beneficial to adopt.

II. CREATING QUALITY KNOWLEDGE THROUGH THE E-LEARNING ENVIRONMENT

Knowledge management can lead to improvements in sharing knowledge - both explicit and tacit - and subsequently benefit the organisation as a whole. Knowledge management in education can be thought of as a framework or an approach that enables people within an organization to develop a set of practices *systematically* to collect information and share what hey know (e.g. skills, experiences, beliefs, values, ideas, etc.), leading to action that improves services and outcomes [23]. Knowledge management can be built and integrated into the structures and processes of educational institutions to improve their performances. Knowledge management can ditbenefit educational institutions in at least five areas: research, curriculum development, student and alumni services, administration, strategic planning, and traditional classroom enhancement [3]. Kidwell et al. argued that knowledge management has several application areas in the curriculum development process.

They are curriculum design and revision efforts, knowledge of teaching and learning (with technology), pedagogy and assessment techniques, student evaluations, etc. Some of the benefits identified are to enhance the quality of curriculum, improve responsiveness to student evaluations, leverage the best practices, improve teaching and learning, and monitor outcomes. Furthermore, Petrides & Nodine (2003) stated several implementation areas where knowledge management practices are useful in educational institutions [23].

One of the areas is enabling educators to create and represent quality knowledge for students to advance and improve their learning. Learning is a process by which students take in information and translate it into knowledge or skills. It has been defined as the process of acquiring knowledge, attitudes, or skills from study, instruction, or experience [24].

Learning outcomes are statements of what is expected that a student will be able to DO as a result of a learning activity. According to Barr et al. (2001), learning outcomes are statements of the knowledge, skills, and abilities the individual student possesses and can demonstrate upon completion of a learning experience or sequence of learning experiences (e.g., course, program, and degree).

The learning activity follows the educator's materials on the e-learning environment or students listening to a lecture based on them, but it could also be a laboratory class, even an entire study programme. Learning outcomes help instructors to be more precise in telling students what is expected of them. A learning audit is necessary to measure the cognitive and behavioural changes as well as tangible improvements that results from the learning process of students [20]. The primary emphasis on knowledge for pedagogical purposes may be for increasing students' learning, which requires a feedback loop in which institutional performance is evaluated, corrective measures are taken, and improvements are made in the knowledge base and practices.

A knowledge management environment which underpins the KM process, comprising (1) physical infrastructure such as people, information technology and building; and (2) nonphysical or virtual infrastructure such as leadership, culture, structure, roles, routines and practices [4]. One of KM‟s aims is to manage intangible assets, like competencies, through managing the abstract elements of the organisational environment [18].

One of the tasks in this complex process of teaching and learning is to code knowledge and to disseminate this knowledge to students in classrooms or through e-learning systems. However, to what extent do students learn by acquiring the requisite knowledge in this way? This question can be addressed by the knowledge management system where knowledge or information concerning student learning and outcomes can be collected and shared amongst the teaching staff.

The knowledge gained by the teaching staff allows them to make appropriate decisions to ensure that their courses, topics, instructional materials, presentations, assignments, assessments, etc. are updated to improve the student learning outcomes. In order to enable educational institutions to use and share knowledge more effectively, a knowledge management system brings together three core organizational resources - people, processes, and technologies.

III. TACIT KNOWLEDGE TRANSFER

Knowledge transfer is an important part ofknowledge management [22], and has been identified as one of the most important managerial issues of the late 1990s [7].This section focuses on the transfer of knowledge within the organization. Earl & Scott (1999) maintain that successful organisations are those that "consistently create new knowledge, disseminate it through the organization, and embody it in technologies, products, and services". Zander & Kogut (1995) regard organisations as social communities that enhance new skills' transfer, communication and capabilities by means of their relational structure and shared coding schemes [14]. They assert that new knowledge is difficult to replicate if there is no "social capability". The aim in this section is therefore to build the basis of a good understanding of the phenomenon of knowledge transfer. Szulanski [7], and O'Dell & Grayson (1998) [13], identify that tacit knowledge – knowledge resulting from experience and intuition – constitutes 80% of the real-value knowledge which is contained in a practice. Since this type of knowledge is very difficult to express and to codify, most of the valuable knowledge usually stays with the transmitter (educator) while the receiver (junior educator or student) often only gets 20% in a codified form.

They further contend that even though the transfer of knowledge does occur, it is sometimes difficult to sustain through time – either though a lack of motivation, interest, training, leadership, connections between the members etc. In practice, there is a real risk of know-how loss during tacit knowledge's conversion to explicit knowledge. There is not as yet an acceptably established procedure to actively manage knowledge within an organization.

However, through the knowledge transfer process, practices are improved when replicated across common communities of practice [18]. He further states effective knowledge transfer can take place when replicated across common communities of practices – thus linking knowledge transfer to communities of practice.

IV. THE LEARNING CAPABILITY OF THE ORGANISATION

Theriou and Chatzoglou [18] summarise the definitions adopted by different academics that the learning organisation (hereafter referred to as LO) is „an organisation which adopts specific strategies, mechanisms, and practices that encourage its members to learn continuously so that they can adapt to the changing business environment‟. These strategies, mechanisms and practices are defined as the learning capability of the organisation.

Dimitriades (2005) argues that to make learning more effective, a strategic learning capability should be developed by linking organisational learning (hereafter referred to as OL) and KM. In other words, to become a LO in today‟s global knowledge economies, firms need to combine the two complementary processes of OL and KM, thereby improving organisational performance and competitiveness [15]. According to Theriou and Chatzoglou (2008), on the one hand, a LO develops a culture which emphasises the importance of learning and creates the right conditions to promote the generation of new knowledge through its OL process.

On the other hand, KM process, within this environment of the LO, is primarily concerned with the accumulation, sharing, utilisation, and use of knowledge assets throughout the organisation. In other words, OL seems to be about managing the creation of the organisation‟s knowledge, while KM is about managing created knowledge efficiently and effectively, thereby optimising the economic value delivered (Spender 2008).

V. KNOWLEDGE MANAGEMENT FRAMEWORK

A common framework for KM includes the following elements [10]:

- a business strategy which guides knowledge strategy through the articulation of objectives and the identification of assets and competencies [10]. KM principles which are the underlying value for the knowledge strategy [10]. Instead, Becerra-Fernandez, Gonzalez and Sabherwal (2004) use KM systems which are the integration of KM mechanisms and technologies and support KM processes.

- KM mechanisms are organisational or structural means to promote KM, such as learning by doing, on-the-job training, learning by observation, face-to-face meetings, and some other more long-term strategies like hiring a chief knowledge officer, cooperative projects across departments, traditional hierarchical relationships, organisational policies, standards, initiation process for new employees, and employee rotation across departments.

Similar to KM mechanisms, KM technologies constitute a key component of KM systems, including (1) artificial intelligence technologies encompassing those used for knowledge acquisition and case-based reasoning systems, electronic discussion groups, computer-based simulations, databases, decision support systems, enterprise resource planning systems, expert systems, management information systems, expertise locator systems, and videoconferencing; and (2) information repositories encompassing best practices databases and lessons learned systems [9].

VI. CONCLUSIONS

Consider an individual educator who possesses knowledge on how to improve student learning outcomes. If the institution relies on only this expert individual to conduct ongoing exercises in improving student learning outcomes, it can hamper the flexibility and responsiveness of the organization. The challenge is to convert the knowledge that currently resides in this individual and make it widely and easily available to any educator. In conclusion, the use of knowledge management in education is an approach that can inform a wide range of practices within an educational organization. For educational institutions, however, the full promise of knowledge management lies in its opportunities for improving student [learning] outcomes. One of the goals of knowledge management in education is to advance and improve student learning by creating quality knowledge. This goal will become increasingly important as school, colleges, and universities come under pressure for increased accountability from external and internal sources [23].

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PUBLIC RELATIONS EDUCATION AND PROFESSIONAL PREPARATION

M. Nikolić[*], M. Magzan[**], E. Terek[*]
[*]University of Novi Sad, Technical Faculty “Mihajlo Pupin”, Zrenjanin, Republic of Serbia
[**]Zagreb School of Economics and Management, Zagreb, Republic of Croatia
mikaczr@sbb.rs, masha.magzan@gmail.com, terekedita@gmail.com

Abstract - The study encompasses topics linked with the education and professional preparation of public relations practitioners, including their characteristics, professionalization, licencing and accreditation process for PR career. Due to multiple roles that public relations play in organizations and society, the goal of the paper is to point out the importance of high quality professional development programs for PR practitioners. Since public relations work assignments include writing and editing, media and community relations, employee relations, problem-solving, management, research and counseling, it is necessary to establish specialized education programs in the field of public relations and increase the number of higher education institutions that would provide them. Due to the fact that employers are increasingly looking for specialized public relations degrees and advanced degrees emphasizing research and social science, PR practitioners may develop very successful careers in many different sectors.

I. PR PRACTICTIONERS' EDUCATION

A. Specific Education for PR Practictioners

The need for specific type of education for PR practitioners emerges from the social and organizational function of public relations which is serving to bring private and public policies into harmony. Public relations deserve credit for their contribution to the public information system that is essential to any democratic society, but also in making organizations responsive to public interests. Therefore, the role of public relations is to help our complex, pluralistic society to reach decisions and function more effectively by contributing to mutual understanding among groups and institutions [2].

Public relations serve a wide variety of institutions in society such as businesses, trade unions, government agencies, foundations, religious institutions. In order to achieve their goals, all of these institutions have to develop effective relationships with many different audiences or publics such as local communities, shareholders and employees, and with society at large. It is certain that the knowledge, professionalism and level of education of PR practitioners is directly linked with the quality of building and maintaining such relationships. PR practitioners basically help the management of different institutions understand better the values and attitudes of their publics in order to reach their institutional goals. By thus, PR practitioners are playing an integrative role both within the organization and between the organization and the external environment. However, the frequent question is: what type of education is needed for PR experts, and which profession is the most suitable one for such professional practice? This question is still asked because of the fact that public relations have emerged on the basis of various fields such as psychology, sociology, communicology, management, marketing, economics, ethics, journalism, politics and culture.

Unlike the traditional view in which journalistic media experience was considered required preparation for public relations employment, today journalism is no longer viewed as a PR prerequisite. Indeed, numerous leading pioneers in the field of public relations started as journalists because their experience in journalism provided them understanding of media gatekeepers' values and ways of working. Although writing and understanding media production process is still of vital importance for public relations, the field of public relations today is much broader than the concept of media relations. PR specialists have to also understand management, marketing, economics, logistics, production/service processes, finances, human resource management, ethics, sociology etc. For this reason Davis [3] points out certain shortcomings of former journalists taking the role of PR practitioner such as insufficient management knowledge, less discerning and more reactive public performance, lack of patience etc.

Recent research [2], suggests that practitioners enter the field from many different academic majors and work experiences. According to Broom [2] about one third of current PR practitioners major in journalism, followed by English, speech, communication and business college majors which are also entering public relations. Just like the trend in USA with English literature majors entering the PR world, in Serbia PR is frequently also done by professors of literature [8]. Knowing all this, it is very difficult to answer the opening question and point out the type of education most suitable for PR practitioners. What is certain however, is an increasing need for developing specialized study programs for the future PR specialists. This is due to the fact that there is lack of general public's understanding of PR as a profession and managerial skill. Furthermore, according to Skoko [9], due to their incomplete education and professional preparation, PR practitioners themselves frequently have distorted picture about the role and social and organizational importance of public relations.

B. Public Relations Study Programs

Formal education of the future PR practitioners is becoming increasingly important. Many higher education institutions around the world offer public relations study programs. Studying public relations is generally done within three academic levels: basic, master and doctoral studies. According to Blek [1], the number of such programs is continuously increasing, as well as the interest of students in applying for such programs.

PR study programs typically have a broad approach in which the students first acquire different general knowledge within public relations. Then, through elective courses and master studies, they specialize in certain segments of PR work and activities [1]. According to Broom [2], examples of the knowledge that may be required in the professional practice of public relations is much wider and includes communication arts, psychology, social psychology, sociology, political science, economics and the principles of management and ethics. Technical knowledge and skills are also required for opinion research, public-issues analysis, media relations, direct mail, institutional advertising, publications, film/video productions, special events, speeches and presentations.

Wilcox and Cameron [11] suggest that the ideal PR study program should contain the following seven key elements:

1. Introduction to public relations
2. Public relations case studies
3. Research, measuring and evaluation in public relations
4. Writing and production in public relations
5. Planning and managing in public relations
6. Public relations campaigns
7. Internal public relations.

There are various approaches in building and executing public relations study programs by different higher education institutions [11]:

- In the USA, there is a tradition that public relations programs are part of journalism departments. Many professionals criticize such approach so due to such pressures, this is slowly changing.
- In Europe, public relations studies are a part of different Faculties and departments, most typically Faculty of Economy or Faculty for Management.
- There is a growing trend of many universities to form special study programs for integrated marketing communications. Such programs focus on public relations, as well as marketing and advertising.

Besides special public relations study programs, many management programs integrate public relations as a separate course. This is because public relations knowledge is becoming very important part for the quality of management efforts. Together with the formal public relations education, there are numerous courses and seminars which are primarily targeting PR practitioners that already have PR jobs, but do not have former PR education. Also, such courses and seminars are useful for further improvement of PR practitioners that have already finished one of the PR study programs.

Such stage of PR professional preparation and education reflects the evolution of this maturing function in organizations and society. It also indicates a sort of the struggle of an emerging profession seeking its own identity as a management function in organizations.

C. PR practitioners' education worldwide and in Serbia

A large number of students worldwide are studying public relations. In the USA only, there are 34000 students in the field of PR and communications. In Europe, around 100 universities offer such programs. Public relations are especially popular among students in transition countries (Serbia, Romania, Lithuania, Estonia, Ukraine and Russia). In Asia, the most prominent PR programs are done at the universities in Korea, India, Thailand, Indonesia, Philippines and China. In Asia, public relations are common at the universities in Korea, India, Thailand, Indonesia, Philippines and China. In South America, the same goes for Argentina, Chile and Brazil. In Africa, the best PR programs are in South African Republic, but also in the other countries such as Nigeria, Ghana and Kenya. Australia and New Zealand have a long history of education in this field [11].However, it is evident that public relations are most developed in the USA, both in terms of PR practice as well as education and professional preparation.

From a theoretical point of view, the concept of public relations is present in Serbia since 1980s while in Croatia the first employment position of a PR manager was opened in 1964. for the hotel Esplanade in Zagreb. With the later development of tourism on the Adriatic coast, more PR positions are opening in tourism and hospitality industry. However, it was not before 1990 when Croatian government formed an information office comparable to modern PR office today. At the same time public relations activities in Serbian companies were slowly starting. Both Croatia and Serbia legged behind the development of PR as a profession in neighboring Slovenia where in early 1990s professional associations and national agencies are already established [9]. In the same period, public relations are established as an independent graduate study at some universities in Serbia (Faculty of Economics and Faculty of organizational science, both in Belgrade). Both in Croatia and Serbia, public relations were mostly studied through informal education and in mid 1990s training centres for public relations have been established. Lecturers in these instructive seminars were mostly practicing from different fields connected with public relations such as journalism, communicology, marketing, promotion and advertising and others. Also, many people entered PR in Croatia and Serbia from different academic majors and work experiences and got re-qualified through gaining practical experience in the field [9].

II. PR PRACTITIONERS' CHARACTERISTICS

Defining the set of personal characteristics and skills needed for many activities and diverse assignments in the day routine of a PR practitioner is a rather complex task. This is because the set of desirable characteristics depends both on the employment position of the PR practitioner as well as the area in which they work. However, according to Wilcox and Cameron [11], generally five key characteristics and skills may be listed:

1. *Writing skill*. The ability to „put on paper“ the information and ideas in a clear and concise way is an essential skill for a PR practitioner. Grammar, syntax and the style of expression are very important for composing effective print and broadcast news releases, feature stories, newsletters, speeches, brochures and different online messages.

2. *Research skill.* PR practitioner has to be able to gather information from various sources about public opinion, trends, emerging issues, media coverage, political and legal issues. Also, this includes conducting surveys, searching the Internet and different databases and other types of research on their own..

3. *Planning skills*. PR programs include different activities which require careful planning and coordination. In order to reach set goals and objectives, administer personnel, budgets and program schedule, as well as to develop effective strategy and tactics, programming and planning in collaboration with other managers is of crucial importance.

4. *Problem-solving*. PR practitioner has to be able to solve complex problems. Innovative and creative solutions are especially welcomed because such approach ensures not only a quality solution to the situation, but also helps in building unique, interesting and recognizable PR programs.

5. *Business and economics competences*. Preparation for the career in public relations has to include a high level of expertise in the field of management, marketing and economics.

Although there is a mix of assignments and responsibilities that vary greatly from organization to organization, one task is typically the common denominator, and that is writing. Besides writing, Davis [3] considers creativity to be one of the two most important characteristics of PR practitioners. He also adds self motivation, proactiveness, intelligence, subtleness, energetic, resilience and maturity. According to Gordon [5], PR specialists must have great communication skills which include presenting, listening, negotiating and managing conflict combined with a clear, concise and persuasive public appearance. These are very helpful skills for serving as liaison with media, community and other internal and external groups.

Besides constantly developing and playing different roles which makes PR not an easy job [1], the research [8], also suggests that PR profession tends to be stressful. For this reason Blek (2003) claims that PR effectiveness depends on the following characteristics: common sense, curiosity, communication skills, adaptability, resilience and attention to details, respectable general education and the ability to put an extra effort. Being 'good with people' and understanding people's needs is very helpful here because PR specialists are frequently dealing with people problems and sensitive relationships.

Research findings show that PR practitioners play several roles in their organizations. Many scholars have used these roles to describe similarities and differences in the practice internationally. According to the level of their activities, PR specialist may fall into the following two categories:

1)PR technicians. PR technicians are primarily concerned with disseminating communications, writing and producing press releases, speeches, annual reports, Web sites and organizing special events. They are both creative and technically proficient and typically exhibit little inclination towards strategic planning and research.

2) PR managers. PR managers are part of organizational management and their role calls for research skills, aptitude for strategic thinking because they are in charge of creating communication strategy of the organization, counseling the top management regarding the communication plans and planning the PR programs and campaigns. They are responsible for the outcomes and impact of public relations activities. Interestingly, according to research done by Dozier and Broom [4], the major predictor of public relations excellence is the extent to which the organization's top public relations executive is able to enact the manager role versus the technician role.

III. Professionalization, Licencing and Accreditation of PR Specialists

There are significant differences among PR practitioners regarding professionalization issue in this field. Some think of PR as a craft, some consider it a skill while others think about it as a fully developed profession. According to Wilcox, Cameron [11], PR should not be considered a profession yet, at least not like medicine or law. The argument is that there are no prescribed educational standards, required internships nor legislative framework that regulate PR as a profession.

From the academic perspective, PR cannot be a profession as long as PR practitioners do not have to have formal education in PR. Nevertheless, maybe the most significant obstacle regarding PR professionalization is PR practitioners' attitude towards their work. They tend to be more focused on their careers (job certainty, job reputation, earnings etc.), rather than professional values [11]. It is no doubt that the debate about PR professionalization will continue. Many think that this is not such an important issue anyway as long as PR specialists do their job professionally, ethically and with high quality standards. However, this issue caused the need for licencing in this field which is a step forward in raising the level of professionalization. When an individual PR practitioner owns a licence, that means they went through serious tests and exams.

The reasons for licencing are the following: [11]

- Better definition of PR practice,
- Setting up unique education criteria,
- Setting up unique professional standards,
- Protection of clients and employees from charlatans and bluffers
- Protection of qualified practitioners from unethical, uncompetent and unfair competition
- Increasing the overall credibility of PR practitioners.

Besides licencing, an important factor for improving the standards and reaching higher level of professionalization in PR practice are the accreditation programs. Having started more than 40 years ago (PRSA-Public Relations Society of America), the goal of accredited programs was to build competent and qualified professionals. Such programs typically contain oral and written exams and a significant amount of seminars concerning building a specific PR plan.

Professional organizations put an extra effort in trying to raise the level of professionalism in PR sector. Some of theses efforts are:

- Collaboration with universities. Primarily this concerns creating quality PR study programs.
- Implementation of research projects. Today research projects contribute to both PR theory and practice but also to scientific component of PR.
- Recognizing prominent individuals in the field. Such people get awards and invitations to different lectures, seminars and conferences where they share their knowledge, experience and motivate other colleagues.

IV. PUBLIC RELATIONS CAREER

PR specialists may work in various organizations. According to the place of their employment, PR practitioners in the USA have the following careers: [11]

- Companies (public and private) 34 %
- Nonprofit organizations 19 %
- PR agencies 17 %
- Government structures (all levels) 10 %
- Independent consultants 8 %
- Education institutions 8 %
- Health institutions 1 %
- Professional associations 1 %
- Other 2 %

Public relations is an attractive profession among top three most popular career choices [7]. Its rapid growth rated it among the 20 most rapidly growing industries in the 1990s (Broom, 2012). Currently there is an increasing demand for PR professionals, both in organizations as well as in PR agencies. Although media often presents PR in a negative way [10] such negative stereotypes do not have much influence and people that enter PR profession may develop successful careers in diverse sectors.

V. CONCLUSION

Studying public relations means the beginning of an exciting career because each day promises something new and different [5]. Therefore, PR perspective is considered generally good due to the following reasons [6]. Firstly, there is an increasing number of scientists and scientific work done in PR. Secondly, the number of PhD programs in PR is increasing, together with international research done in this area. Also, an increasing number of PR specialists are gaining reputation and climbing the top positions in different organizations. Consequently, the concept of public relations is becoming a part of organizational culture which brings better understanding of the value of public relations' contributions to organizations and society.

For all the reasons mentioned above, it is logical that there is a significant interest for further development of PR profession and practice. PR managers should be the people with required knowledge, skills and personal characteristics for this job. Although the selection process is typically not a problem [8], it needs to be carefully executed. It is necessary to develop specialized education programs in PR and increase the number of higher education institutions that would provide them. This would undoubtedly help raising the level of professionalization and ensure employment opportunities for qualified and competent people.

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TEACHERS' PERCEPTION OF SCHOOL CULTURE IN SERBIAN PRIMARY SCHOOLS

B. Gligorović, E. Terek
University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
bojanagligorovic@gmail.com, terekedita@gmail.com

Abstract – This paper aims to analyse teachers' perception of school culture in Serbian primary schools. The participants were 362 teachers from 57 primary schools in Serbia who expressed their opinion about sixteen dimensions of school culture: Collegiality, Experimentation, High Expectations, Reaching Out To Knowledge, Appreciation & Recognition, Professional Respect, Protecting What's Important, Tangible Support, Decision-Making, Honest, Open Communication, Initiative, Collective Responsibility, Continuous Improvement and Non-Defensiveness, Reflective Environment, Goals, and Core Values. The results indicate that all school culture dimensions are relatively highly rated by the teachers but that the dimensions Goals and Core values have the highest average grades. The findings provide important information for understanding teachers' perspectives on school culture in Serbian context.

I. INTRODUCTION

School culture is one of the most complex and the most important concepts in education. The concept arrived in education from the corporate environment with an idea to provide direction and guidance to achieve more efficient and stable learning environment. Examining the school culture is very important because, even though the schools may resemble each other in many ways, each of them has its own ambience or culture, and in fact, careful observation of that ambience can be useful for finding approaches to make schools better and more successful.

The culture describes "the way things are done" in school and serves as a window or a lens through which the outside world is observed [1]. In essence, the culture defines reality for employees within the school, gives them support and identity, and creates a framework for professional learning. Each school has a different reality or the mindset of school life. Also, each school has its own unique attitude in relation to what is happening in its external environment. Culture is, thus, situationally unique [2]. School culture reflects local culture in many ways [3, 4]. When the school is trying to improve itself, it is necessary to focus both on its own values, beliefs and norms, as well as the values, beliefs and norms prevailing in its external environment [5, 6]. Accepted values of the culture include school strategies, goals and philosophy. Activities and daily routine, carried out by the school administration and teachers should be in accordance with the theory in practice or the way in which things are done. Harmonization of the accepted values (what is considered true) and the theory in practice (how the things are actually done) should be the goal of every school. Also, it is important to determine whether the students and teachers are successful in the current school culture (is it healthy or unhealthy), as the quality of teaching and learning defines the theory in practice. In a healthy school culture, according to [7], there is a correspondence between the accepted values and everyday behaviour of the school members. The compliance between objectives and practices of school reveals the connection between the representation of the desired objectives and the current reality. That compliance reflects the school effectiveness and the fact that school is doing the right things [7].

Reference [8] argues that the school culture informs teachers about what the teaching means, which teaching methods are available and accepted for use, as well as which of them are receptive to students and which are not. In addition, culture plays an important role in defining teachers' commitment to responsibilities and tasks, instils in them energy for performing tasks that are expected and promotes loyalty and commitment to the school and its ideals. Reference [9], believes that a successful school culture serves as a compass that focuses employees to a common direction, provides a set of standards that define what employees should achieve and how, and a source of meaning and importance to teachers, students, principals, and all others involved in school life.

Schools with strong culture has a "vision" of excellence, while those with weak culture are characterized by a lack of understanding, determination and vigour to what should be achieved [9]. Recognizing the enormous impact of school culture, both on the students and the teachers, [10] Barth (2002) states that the school culture has a much greater impact on the life, learning and teaching in schools the Ministry of Education, school superintendent, school board, and even the principal have. Therefore, [10] was quite right when he said that the influence of school culture is undeniable.

II. DEFINITIONS OF SCHOOL CULTURE

The field of education lacks a clear and consistent definition of school culture. The term school culture is often mistakenly identified to closely with the concepts of "school climate", "school ethos" and "saga" [11]. Eminent experts on this field point out that there are as many definitions as there are the authors. Some of them are given below.

School culture denotes complex rituals that define the way in which schools operates [12]. According to [13], it consists of shared philosophies, ideologies, beliefs, feelings, assumptions, expectations, attitudes and values that determine how the school works. School culture is a shared set of beliefs, values and practices that members of the school community have about how things in school are performing [14]. In reference [15], the authors claim that school culture is a complex web of traditions and rituals that have been building up over time, while teachers, students, parents and administrators work together and deal with the crisis, but also with achievements. Cultural patterns are very durable, have a powerful influence on performances, and shape the way school members think, work and feel [15]. School culture is not easy to describe because it includes people beliefs, values and norms governing the school [16]. According to reference [17], school culture is an interaction between the following factors: the attitudes and beliefs of stakeholders inside and outside the school, cultural norms of the school, and the relationship between individuals in the school. School culture is based on commonly held beliefs of teachers, students and principals [18]. Reference [19] defines school culture as a network of underground flow of feelings and customs making their way through the school in the form of visions and values, beliefs and assumptions, rituals and ceremonies, history and story, and physical symbols while reference [20] describes it as an accumulation of values and norms of many individuals in the school. School culture is manifested in the written policies, mission statements, philosophies, objectives, and rules. But the most significant illustration of the culture is in the actions of the school management, teachers and students as reflected in the rituals, ceremonies, approaches to learning and everyday school activities [21]. School culture represents a guiding beliefs, assumptions and expectations evident in the way the school functions [22]. In reference [23], the authors state that school culture means the dominant ethos of the organization, its values and vision, and the common experiences of school community members whereas according to reference [24], it consists of basic assumptions, norms and values, as well as cultural artefacts common to school members, affecting their functioning in school. In an implicit sense, school culture is manifested in the rituals, customs, stories, the way employees treat each other and cultural artefacts such as language [25]. School culture includes common experiences inside and outside school (traditions and celebrations), sense of community, family and team [26].

III. ELEMENTS OF SCHOOL CULTURE

Culture exists wherever people live and work. The amount of time that students, teachers and community members spend at school creates cultural elements that directly affect their activities and functioning.

In reference [27], the authors believe that school culture can be best understood through cultural norms. They identified 12 school culture norms that impact school effectiveness on its way to improvement. The norms are:

- **Collegiality** – the extent to which professional staff members in school use their talents and knowledge to help each other.
- **Experimentation** – the extent to which school management and colleagues encourage and support experimentation with new ideas and techniques, because in this way teachers and school improve.
- **High expectations** – the extent to which school members have a constant focus on teaching students with continual conversation about the quality of everyone's work.

- **Trust and confidence** – the extent to which school members can rely on a close, supportive teacher - student, teacher - teacher, teacher - principal, student - student, and parent - school relationship. The sense of community contributes to this factor.
- **Tangible support** – the extent to which professional staff members in school and other employees receive sufficient incentive, resources (including teamwork and time) and are able to effectively fulfil their professional obligations and contribute to the welfare of the school.
- **Reaching out to knowledge base** – the extent to which school management and employees use timely and accurate, qualitative and quantitative information in order to constantly foster their processes, performance and results. This includes plans and programs, instructional materials, assessment, learning opportunities clearly associated with the mission and vision of the school and adapted to students needs and interests.
- **Appreciation and recognition** – the extent to which school community shows gratitude and appreciation to those members of the school who significantly contribute to the organization or its members. School customs, traditions and general way of doing things illustrate the level of this characteristics in practice.
- **Caring, celebration, and humour** – the extent to which school members value care, celebration and humour, show care for one another, are aware of the significant events in the lives of other members and celebrate the events that are important in work and life of the school.
- **Involvement in decision-making** – the degree of participation approved by school administrators to teachers, staff, students and parents to receive relevant and timely information, discuss their significance in relation to the values and goals of the school and participate in decisions concerning school and its development.
- **Protecting of what is important** – the extent to which school administration protects teachers' time dedicated to teaching and planning by keeping meetings and paperwork to a minimum.
- **Traditions** – the extent to which school has established traditions, both in terms of the curriculum, and in terms of maintenance of periodic events significant and recognizable to school members.
- **Honest, open communication** – the extent to which school provides the opportunity, time and space for the exchange of information in a clear and unequivocal manner between school members. This includes the creation of culture, discussion of basic values, taking responsibility, acting as a community and celebrating individual and group success.

IV. METHOD

A. *Research instruments*

The School Culture Survey [27], was used as an instrument for measuring school culture. The survey has 24 items relaing to teacher norms (qualities of the environment that teachers experience), beliefs (about how the school should operate) and core values (what the school wants for its students), using a 5-point Likert scale (1 - Almost never; 2 - Less often than not; 3 - About half the time; 4 - More often than not; and 5 - Almost always). The subscales of school culture are: Collegiality, Experimentation, High Expectations, Reaching Out To Knowledge, Appreciation & Recognition, Professional Respect, Protecting What's Important, Tangible Support, Decision-Making, Honest, Open Communication, Initiative, Collective Responsibility, Continuous Improvement and Non-Defensiveness, Reflective Environment, Goals, and Core Values.

B. *Respondents and data collecting*

The research was carried out in Serbian primary schools. The questionnaires were distributed personally to all the teachers in the sampled primary schools who expressed their opinion about culture in their school through their responses. A total of N(0) = 383 teachers from 57 schools answered the questions. After the initial analysis, because of the significant dispersion of results, 21 questionnaires were rejected. Thus, the total number of respondents was N = 362. The total number of respondents N = 362 consisted of 250 women and 112 men.

C. *Descriptive analysis*

The descriptive statistics for the dimensions of school culture are shown in Table 1. In the table, among other things, the names of the dimensions, the short names for each dimension (which are used hereafter), mean size and standard deviation

TABLE I. DESCRIPTIVE STATISTICS

Dimensions	Short name	N	Min.	Max.	Mean	Std. Deviation
Collegiality	SC1	362	1.00	5.00	3.8033	.85425
Experimentation	SC2	362	1.00	5.00	3.9586	1.07138
Reaching Out to Knowledge Base	SC3	362	1.00	5.00	3.9696	.99954
High Expectations	SC4	362	1.00	5.00	3.9144	.96237
Appreciation and Recognition	SC5	362	1.00	5.00	3.7845	1.00027
Protecting What's Important	SC6	362	1.00	5.00	3.7459	1.06651
Tangible Support	SC7	362	1.00	5.00	3.6989	1.10674
Professional Respect	SC8	362	1.00	5.00	3.6243	1.06689
Decision-Making	SC9	362	1.00	5.00	3.6367	.99302
Honest, Open Communication	SC10	362	1.00	5.00	3.6865	.99537
Initiative	SC11	362	1.00	5.00	3.9530	.98774
Collective Responsibility	SC12	362	1.00	5.00	3.8177	1.03132
Continuous Improvement and Non-Defensiveness	SC13	362	1.00	5.00	3.9530	.95928
Reflective Environment	SC14	362	1.00	5.00	3.7541	.98622
Goals	SC15	362	1.00	5.00	4.0166	.93841
Core values	SC16	362	1.00	5.00	4.1768	.83737

are given for each dimension.

V. DISCUSION

Within descriptive statistics (Table 1), it is important to give consideration to the total average grade for all sixteen dimensions of school culture which is 3.8434. This total average grade is not so bad considering the unfavourable status of teachers and teaching profession in Serbian society as well as the poor working conditions in Serbian schools.

The highest average grades of all school culture dimensions are evidenced for the SC15 - Goals and SC16 – Core values, while the lowest average grades can be noticed at SC8 – Professional respect and SC9 – Decision-making. These results indicate that Serbian primary schools as educational institutions know what they want for their students but obviously do not have a clear idea what they want for their teachers and how to create a school culture where the teachers will feel respected and be involved in decision-making.

According to Table 1, the dimension SC16 – Core values is most highly rated by Serbian primary teachers meaning that primary schools in Serbia generaly know what they stand for as a school, that their educational objectives in teaching students are clear and visible even beyond the scope of the schools, and that their programs are in compiance with the school mision and vision, and support core values. This result is very promising indicating that even if they have been facing many chalanges for a few past decades, Serbian primary schools are still strongly dedicated to the core aspect of their work: teaching students.

School culture dimension SC15 – Goals, also has a very high average grade (Table 1), meaning that in Serbian primary schools enough time is spent clarifying and understanding the school goals. The school community is familiar with the objectives which have to be achieved and Serbian schools themselves possess a clear vision of that they want for their students and know how to accomplish that.

On the other hand, in terms of school culture dimension SC8 – Professional respect, a very low average grade can be noticed. This is not surprising considering the fact that the reputation of teaching profession has deteriorated in the past two and a half decades. The frequent changes of educational strategies, policies and directives are very stressful for teachers making them feel lost and leaving no room for creativity or taking initiatives. The result indicate that Serbian primary teachers work in school culture where they do not feel trusted and encouraged to make instructional decisions on their own while school administrators do not help and support them when they do.

School culture dimension SC9 – Decision-making is also lowly rated by Serbian primary teachers indicating that the degree of participation approved by school administrators to teachers, staff, students and parents to discuss relevant information and their significance in relation to the values and goals of the school and participate in decisions concerning school and its development is not on a high level. According to the result, the teachers feel they are not much consulted about decisions to be made in their school and much listened to, neither can they influence policy, while the decision-making processes are not always seen as fair and legitimate.

VI. CONCLUSION

This paper reveals that school culture in Serbian primary schools has clear goal orientation and is focused on students, which is an exceptionally positive result, but does not pay sufficient attention to those on whose work the prosperity and success of current and future generations depend – the teachers. According to the results, the teachers are expected to be highly dedicate and give their best but, in turn, they get very little. They reported a relatively low involvement in decision-making as well as low professional respect. Therefore, improvements are especially necessary in the dimensions of teacher participation in decision-making and the professional treatment of teacher.

School leaders are the most important factors in shaping, improving and changing school culture. By incorporating mechanisms that will encourage professional development and teacher involvement in the planning process, decision making and implementation of change in the education system, and by deepening their understanding of school culture, school leaders could be more sucessul in creating the values, beliefs, and attitudes essential to promote a nutriting school environment for Serbian primary teachers well-being as well as student learning.

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IT PROJECT OF THREE LAYER APPLICATION DEVELOPMENT

Z. Vuković, V Makitan
University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
zvukovic76@gmail.com, vesna@tfzr.uns.ac.rs

Abstract – The main purpose of this paper is to present implementation of the IT project management course education in the real IT project realization. IT project management course is one of the subjects at the master studies at Technical Faculty "Mihajlo Pupin" in Zrenjanin. The knowledge about IT project management methodology gained in that course was used in realization of the IT project of three layer web based application development for the "Vojvodina vode" company. This application is created in the Oracle Developer Suite 10 and Oracle Database 11 and it enables calculation of the interest for the budgeted users in accordance with the law about tax procedure and tax administration. The paper describe implemented IT project management methodology presented by the business model with projects' goal, present state, critical assumptions and constraints, analysis of possible solutions, demands, financial analysis and budget determination, timetable, risks, resources and stakeholders, as well as project realization and its results.

I. INTRODUCTION

According to IT project management methodology [1,2] this paper describes realization of the project for three layer web application development that enables calculation of interest by simple and compound interest calculation. The application is realized in Oracle Developer Suite 10 and Oracle Database 11. It was intended for budgeted users that calculate interest in accordance with the law about tax procedure and tax administration. This application is implemented in "JVP Vode Vojvodine" company and it is contained of two parts:

1. Part that enables entry of debt and demand of client (debtor);
2. Part that enables interest calculation with related reports.

The user chooses simple or compound interest calculation when he/she defines interest rate. The report about calculated interest is available to the user as *.pdf document or it may be exported in the *.xls table. The application had modular development and it may be easily implemented in other parts of the system. In that way, the status preview about client debts (amount and interest) is simplified, and represents the basis for entire set of actions, such as: report about debt status, warning about enforced collection, enforced collection and reprogram of debt.

Implemented methodology for this project realization was IT project management methodology and the paper describes its main steps: the business model description with projects' goal, present state, critical assumptions and constraints, analysis of possible solutions, demands, financial analysis and budget determination, timetable, risks, resources and stakeholders, as well as project realization and its results.

The project organization was the "JVP Vode Vojvodine" company that, by its business, covers Vojvodina territory of 21506km with approximately two million inhabitants. The water business has general interest and its activities are divided based on:

- Arrangement of water flow and protection from the harmful effects of water;
- Arrangement and water using;
- Water protection from pollution;
- Development, maintenance and management of irrigation, regional and multipurpose hydro systems;
- Other activities of general interest. [3]

The law about water arranges legal water status, integral water management, water objects and land management, sources and modality of water activities financing, supervision under law implementation and other questions important for management.

Financial sources for the water management area are from:

- Republic of Serbia budget;
- Autonomous Province of Vojvodina budget;
- Water fees;
- Concession fees;

- Other sources.

Water fees are public income and they are fees for: using water goods, drained water, and water pollution, drainage, using water objects and systems and catchment water charge. Every individual or legal entity that in some way uses water resources are obligated to pay adequate compensation for that service. Based on concluded contracts with the competent institution (“JPV Vode Vojvodine”), that controls water resources, individuals or legal entities get resolution with calculated amount that should be paid in legally defined deadline on one of the prescribed budget accounts. Otherwise, interest will be calculated according to interest rate prescribed by the National bank of Serbia. Individuals or legal entities that use water resources may be recorded, informed about debt status, warned before enforced collection, involved in enforced collection procedure and given resolution about debt reprogram.

II. Business Model

A. Project goal

As it was mentioned before, project goal is creation of the web application that will enable interest determination by simple and compound interest calculation. The application should be modularly made and implemented in other parts of the system.

It should enable that operator may entries debt and demand amount of a client and to adequately report about client debt status. It is necessary to send this report to a client by companies’ site or e-mail.

Full protection of client data is demanded and it will be accomplished by disabling unauthorized access on both, based and applicative level.

B. Present state description

The application that was in use could support only character interface and it was possible for usage only by telnet protocol which is considered unstable.

The client data may be entered without any control. Practically it is possible that one user has more than one entry and, in that way, more debt statuses, which is unacceptable.

Report format that application gives does not satisfy companies’ management, because they may be printed only at matrix printers.

Application was developed by the third party and it involves monthly costs of maintenance.

C. Critical assumptions and constraints

The submitted IT project of application development must be supported by its initiators and by every employee who is going to use the application.

The application may not have any additional expanses for hardware or software upgrade.

User interface must be as simple as possible and security of user data must be guaranteed.

D. Analysis of possible solution

There are two possible solutions:

1. To make a tender and engage other company that will realize the project in accordance with technical specification, i.e. project documentation;
2. Engage your own IT department for project realization.

Having consulted each stakeholder and considering experiences with the previous application, it was decided that second solution should be implemented.

E. Project demands

It is necessary to create application that will enable:

- Recording of clients with related data available to the Agency of business registers;
- Recording of interest rates, kind of the interest calculation (simple or compound) and label of interest rate (yearly, monthly or daily);
- Recording of debt and demand amount of a client through account entries;
- Determining interest by simple or compound interest calculation that is defined at interest rate level;
- Reports about debt status of a client;
- Generating reports about debt status in *.xml and *.xls format.

F. Budget estimation and financial analysis

Considering the fact that this project is an “in-house” solution (realization is given to the IT department of “JVP Vode Vojvodine” company), project budget is an integral part of the companies’ budget.

Financial benefit is related to the fact that there are no monthly maintenance costs of created application.

On the other hand, nonmaterial benefit is related to the fact that changes, as well as adding new features in the application will be much easier because it is an in-house solution.

G. Timetable estimation

Activities for IT project of three layer application development are given in the Figure 1.

ID	Task Mode	Task Name	Duration	Start	Finish	Predeces	Resource Names	WBS
1		**Projekat**	**72.5 days**	**March 28, 2015 8:00 AM**	**July 8, 2015 12:00 PM**			**1**
2		POČETAK PROJEKTA	0 days	March 28, 2015 8:00 AM	March 28, 2015 8:00 AM			1.1
3		**Planiranje projekta**	**15 days**	**March 30, 2015 8:00 AM**	**April 17, 2015 5:00 PM**	**2**		**1.2**
4		Sastanak projektnog tima	1 day	March 30, 2015 8:00 AM	March 30, 2015 5:00 PM	2	Projektant - sistem analitičar,Programer	1.2.1
5		Pisanje plana projekta	3 days	March 31, 2015 8:00 AM	April 1, 2015 5:00 PM	4	Programer,Projektant - sistem analitičar,Računar 1,Račun	1.2.2
6		Razmatranje i analiza korisničkih zahteva	3 days	April 2, 2015 8:00 AM	April 6, 2015 5:00 PM	5	Programer,Projektant - sistem analitičar	1.2.3
7		Sastanak projektnog tima i podela zadataka	2 days	April 7, 2015 8:00 AM	April 8, 2015 5:00 PM	6	Programer,Projektant - sistem analitičar	1.2.4
8		Izrada, izmene i usvajanje projektne	12 days	April 9, 2015 8:00 AM	April 17, 2015 5:00 PM	7	Programer,Projektant - sistem analitičar,Računar	1.2.5
9		ZAVRŠENO PLANIRANJE	0 days	April 20, 2015 8:00 AM	April 20, 2015 8:00 AM	3		1.3
10		**Realizacija projekta**	**55.5 days**	**April 22, 2015 8:00 AM**	**July 8, 2015 12:00 PM**	**9**		**1.4**
11		**Modeliranje**	**4 days**	**April 22, 2015 8:00 AM**	**April 27, 2015 5:00 PM**	**9**		**1.4.1**
12		**Izrada UML dijagrama**	**3 days**	**April 22, 2015 8:00 AM**	**April 24, 2015 5:00 PM**	**9**		**1.4.1.1**
13		Izrada dijagrama slučajeva korišćenja	1.13 days	April 22, 2015 8:00 AM	April 22, 2015 5:00 PM	9	Projektant - sistem analitičar,Računar 1	1.4.1.1.1
14		Izrada dijagrama klasa	1.13 days	April 23, 2015 8:00 AM	April 23, 2015 5:00 PM	13	Projektant - sistem analitičar,Računar 1	1.4.1.1.2
15		Izrada dijagrama sekvenci	1.13 days	April 24, 2015 8:00 AM	April 24, 2015 5:00 PM	14	Projektant - sistem analitičar,Računar 1	1.4.1.1.3
16		**Modeliranje podataka**	**1 day**	**April 27, 2015 8:00 AM**	**April 27, 2015 5:00 PM**	**15**		**1.4.1.2**
17		Kreiranje SQL skripta	0.5 days	April 27, 2015 8:00 AM	April 27, 2015 12:00 PM	15	Projektant - sistem analitičar,Računar 1	1.4.1.2.1
18		Kreiranje idejnih skica ekrana	0.63 days	April 27, 2015 12:00 PM	April 27, 2015 5:00 PM	17	Programer,Projektant - sistem analitičar,Računar 1,Račun	1.4.1.2.2
19		ZAVRŠENO MODELIRANJE	0 days	April 28, 2015 8:00 AM	April 28, 2015 8:00 AM	11		1.4.2
20		**Izrada aplikacije**	**16 days**	**April 28, 2015 8:00 AM**	**May 19, 2015 5:00 PM**	**19**		**1.4.3**
21		Kreiranje baze podataka iz SQL skripta	1.13 days	April 28, 2015 8:00 AM	April 28, 2015 5:00 PM	19	Projektant - sistem analitičar,Računar 1	1.4.3.1
22		Izrada formi (maski) na osnovu dijagrama	58 days	April 29, 2015 8:00 AM	May 18, 2015 4:00 PM	21	Programer,Projektant - sistem analitičar,Računar	1.4.3.2
23		Povezivanje formi (maski) u celinu	1.13 days	May 19, 2015 8:00 AM	May 19, 2015 5:00 PM	22	Programer,Računar 2	1.4.3.3
24		ZAVRŠENA IZRADA APLIKACIJE	0 days	May 20, 2015 8:00 AM	May 20, 2015 8:00 AM	20		1.4.4
25		**Testiranje aplikacije**	**16 days**	**May 20, 2015 8:00 AM**	**June 10, 2015 5:00 PM**	**24**		**1.4.5**
26		Alfa testiranje	25.13 days	May 20, 2015 8:00 AM	May 28, 2015 5:00 PM	24	Programer,Računar 2	1.4.5.1
27		Beta testiranje	31.13 days	May 29, 2015 8:00 AM	June 8, 2015 5:00 PM	26	Programer,Računar 2	1.4.5.2
28		Ispravljanje bug-ova	4.13 days	June 9, 2015 8:00 AM	June 10, 2015 5:00 PM	27	Programer,Računar 2	1.4.5.3
29		ZAVRŠENO TESTIRANJE APLIKACIJE	0 days	June 11, 2015 8:00 AM	June 11, 2015 8:00 AM	25		1.4.6
30		**Ažuriranje projektne dokumentacije**	**2 days**	**June 11, 2015 8:00 AM**	**June 12, 2015 5:00 PM**	**29**		**1.4.7**
31		Ažuriranje dokumentacije	1.13 days	June 11, 2015 8:00 AM	June 11, 2015 5:00 PM	29	Programer,Projektant - sistem analitičar,Računar 1,Račun	1.4.7.1
32		Pisanje korisničkih uputstava	3 days	June 11, 2015 5:00 PM	June 12, 2015 5:00 PM	31	Programer,Projektant - sistem analitičar,Računar 1,Račun	1.4.7.2
33		ZAVRŠENO AŽURIRANJE PROJEKTNE	0 days	June 15, 2015 8:00 AM	June 15, 2015 8:00 AM	30		1.4.8
34		**Isporuka i implementacija aplikacije**	**17.5 days**	**June 15, 2015 8:00 AM**	**July 8, 2015 12:00 PM**	**33**		**1.4.9**
35		Instalacija aplikacije	0.5 days	June 15, 2015 8:00 AM	June 15, 2015 12:00 PM	33	Programer,Računar 2	1.4.9.1
36		Obuka korisnika	1.5 days	June 15, 2015 1:00 PM	June 16, 2015 1:00 AM	35	Programer,Računar 2	1.4.9.2
37		Probni rad aplikacije i pružanje podrške	15 days	June 17, 2015 8:00 AM	July 7, 2015 6:00 PM	36	Projektant - sistem analitičar[20%]	1.4.9.3
38		Ručak nakon završenog projekta	0.5 days	July 8, 2015 8:00 AM	July 8, 2015 12:00 PM	37	Prezentacija[10,000.00 ? ??.]	1.4.9.4
39		ZAVRŠENA ISPORUKA I IMPLEMENTACIJA	0 days	July 8, 2015 8:00 AM	July 8, 2015 8:00 AM	34		1.4.10
40		ZAVRŠENA REALIZACIJA PROJEKTA	0 days	July 8, 2015 8:00 AM	July 8, 2015 8:00 AM	10		1.5
41		ZAVRŠEN PROJEKAT	0 days	July 8, 2015 8:00 AM	July 8, 2015 8:00 AM	1		2

Figure 1. Project activities

H. Potential risk

The biggest potential risk of this project success is the opposition of employees to the new application.

I. Project resources

Project team members assigned for application development were:

- System analyst – in case of this project it is the same person as the project manager;
- Programmer.

Other resources are:

- Two desktop computers;
- System software: Windows 2008 server, Windows 7 Professional;
- Oracle Database 11g;
- Oracle Developer Suite 10g.

J. Project stakeholders

Project stakeholders are:

- “JVP Vode Vojvodine” company, as initiator of the project and project organization;
- Team members from IT department;
- Employees from “JVP Vode Vojvodine” who work at accounting department and have data about debt of clients;
- All clients who have payment obligation for using water resources under “JVP Vode Vojvodine” management.

During project realization it is important to establish good cooperation between IT department team members and employees who will use the application, especially concerning consulting, advising and testing.

III. Project Realization

The application is realized in Oracle Developer Suite, because project organization has licenses for this software.

Minimal hardware requirements for application installing, running and using were: 1GHz processor (32bit or 64bit), 1GB RAM memory for 32bit operating system or 2GB for 64bit operating system and 100MB free space at hard disk.

Minimal software requirements necessary for the application ware: operating systems that have one of the web browsers with Java support, JRE 6.

During the project realization big support for team members was from the management of project organization and in that way project could continue smoothly. Moreover, initial opposition of employees to the new application was decreased, and at the same time, interviews with operatives as well as the business analysis could be finished.

After the application development, its installing could start. Probation of employees was supported by the team members who developed application. During this period some changes and modifications of application, which was initiated by employees, were done. The aim was to get the best version of the application.

Detailed user manual was created and its e-format (*.pdf) is available to every application user.

The flow of application functioning may be presented by UML diagram from the Figure 2.

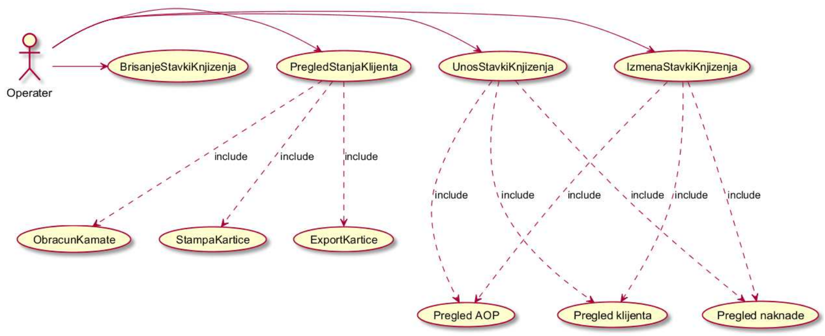

Figure 2. Use case diagram

This is a graphical illustration of a system functioning (static approach), that represents participants (Actor) and their use-cases, i.e. user view on system functioning (what system does, and not how it does).

IV. Project Results

The result of this project is three layer application for interest calculation by simple and compound interest calculation. The main characteristics of this application are:

- Application may be accessed by intranet through any web browser with Java support;
- Protection of unauthorized access is provided. Once the application has been started, the form for user name and password appears. Protection is double: it is conducted at based and applicative level. According to entered user name and password, authentication follows, and depending on defined roles for particular user, level of rights to the application is determined;
- Physical deleting of any data is not allowed. "Logical" deleting of data records is in use. That means that particular record gets status in accordance with user actions;
- Entry and changes of codebook;
- Entry and changes of debt and demand amounts of a client;
- Data search by any criteria;
- Data sort by chosen criteria;
- Interest calculation for clients who did not settled the obligations in prescribed deadline;
- Report about client debt status printing;
- Export of data about client debt status in *.xml and *.xls format;
- User manual.

V. Conclusion

This paper showed the implementation of IT project management methodology, its tools and techniques in the real project realization. The knowledge about this is gained at the IT project management course, studied at Technical faculty "Mihajlo Pupin" in Zrenjanin. It enabled better planning, less error occurring and overall project success.

Developed three layer application is in usage in "JVP Vode Vojvodine" company from 2012 and at the satisfaction of every project stakeholder.

Acknowledgment

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DEVELOPMENT AND INFLUENCE OF IT ON TEACHING

AUGMENTED REALITY AND CLOUD COMPUTING IN INFORMATIONAL AND COMMUNICATIONAL TECHNOLOGIES IN TECHNOLOGICAL EDUCATION

S. Plachkov, V. Pavlova, E. Tosheva
Faculty of Pedagogy, SWU "Neofit Rilski", Blagoevgrad, Republic of Bulgaria
pla4kov@swu.bg, vasy_pav@abv.bg, emilia_tosheva@abv.bg

Abstract – This article presents the opportunities of two modern technologies about integration of informational and communicational technologies in technological education in Bulgaria – the technology "Augmented Reality" and "Cloud technology".

I. INTRODUCTION

The integration of web-technologies in technological education is determined on social needs and expectations to modernize the learning process. Web-based education provides new opportunities for the development of the education, for the realization of the idea of eternal learning and to personalize the learning process. The advent of Informational and communicational technologies (ICT) in technological education is objectively determined to the needs of the "net generation". That generation is not only technologically literate, but it's also technologically related and dependent. The everyday contact with digital technologies creates in "net generation" knowledge, skills and a way of thinking that are very different from those of previous generations. A significant place in the integration of these technologies take digital competences [4].

II. AUGMENTED REALITY

The **"Augmented Reality" technology** is a new generation of IT based tools, supporting educational and training institutions in an effective and attractive way. This reality combines the features of the reality and of the virtual world and allows the users to gain a new attractive and spectacular view on the educational content. Augmented Reality (AR) is a technology that enrichies the sensory perception of a person by adding virtual content directly on the environment to the user. This is a technology that presents in real time details (like graphics, text, audio and etc.) about the users surrounding environment, caught by the camera of smartphones and other devices. It is related to more summury conception, called mediated reality in which the view of the reality is modified (sometimes even reduced than enhanced) by the computer. As a result, the technology functions by enhancing the perception of the object to reality. In contrast, virtual reality changes the real one with simulated one. With the help of advanced AR technology (by adding a computer vision and objects recognition) information about the user surrounding world transforms into interactive and digitally manipulable. Augmented reality (AR) provides smooth immersion of the reality by leaving the connection to the real world and superimposes computer-generated images on real artifacts.

According to Chang, G., Morreale, P., & Medicherla, P. (2010) – researchers that suggest that the learners can enhance their motivation of learning and improve their educational practices with augmented reality [1]. Despite the large amout of research in the last two decades, the adoption of AR in education is still more challenging because of problems with its integration with traditional training methods, the cost of the development and the maintenance of the system for analyses and sustainability of new technologies. (Kerawala and etc., 2006) states that althouth most AR applications have been developed for education and training purposes, since the advent of AR in late 1960, its potential is just beginning to be researched and used in real life. It emphasized that AR has the potential to make students to be more engaged and motivated in finding the resources which they can apply in real world from different perspectives that will have never been implemented in the real world [2].

Johnson, et. Al. (2010) states, "AR has a strong potential to provide a powerful educational experience that drives researches and discoveries, connected to the information in the real world" [3].

Augmented Reality (AR) allows teachers and students to do exactly that: to unlock or to create layers of digital information to the physical world which can be viewed through Android or IOS devices.

The possibilities of the technology allow the educational content to be presented by adding graphics, audio, video, 3-dimensional images and many other computer applications. On the one hand, the uses of this technology in educational and training process create one more effective and more attractive way of teaching, on the other hand make the educational content more attractive and more understandable for the students.

With augmented reality there is the possibility to raise the quality of education within the curriculum. By exposing the experience this technology has the potential to help to change the teaching methods from passive to active, and the students "by recipients of the content" to become the active role in collecting and processing the information as a way of gathering knowledge.

This technology allows to have practical training on topics, too dangerous or impossible to direct presentation, and may not need a physical classroom. All that can be too real: from teleconference, about virtual classrooms, interactive lessons, to virtual realities of the next stage.

The use of different smartphones can allow experimentation and evolution of this technology; unknown for the students places can be seen closely, providing the possibility of learning outside the classrooms. Promoting the non-formal education can be quite effective in engaging the students with non-traditional presentation of the educational materials which can help them on one hand in enriching their knowledge, on the other hand in the context of sharing it.

In other words AR environment combines real and virtual environments between the object and the reality in real time, uses the four dimensions (the three-dimension space and the time) but the virtual objects can be fixed or manipulated.

There are different platforms which use augmented reality to present specific information and which could be used in education:

- AURASMA [6] has the ability to "make alive" the surrounding world by adding in it new informationa and objects. This platform can be used for pleasure, and for practical purposes.
- BASEAURA [7] it works in partnership with Wikitude to create the most dynamic and intuitive Augmented Reality environment. After Wikitude application is downloaded for free from AppStore, / Google Play with the smartphone every element arround us (which can be an image too) can be scanned with a built augmented Base Aura.
- *COLAR MIX*
  From the web site of the application print a ready image /in which there is a built marker for augmented reality/ and can be colored with markers [9].
- *LARGE*
  The project - Learning Augmented Reality Global Environment (LARGE) – creates a new type educational environment which can help the educational/training institutions to provide the learning program in the most attractive and effective for the students way. The AR system generates one environment which combines the real scene with the virtual scene, generated from a computer and adds more information [10].

III. Cloud Technologies in Technological Education

The new model of computer technologies receives the name of "cloud computer technologies", and the cloud is a metaphore for the Internet, i.e. technologies and services available over the Internet. One of the most rapidly developing and promising technologies today is "the calculation in the cloud" (Cloud computing). Even if we do not realize it, the cloud technologies have already become an integral part of our daily lives. Every day we use the services, provided by Google, Facebook, Twitter and etc.

They all work according to the principles of the cloud computing – all user information is stored on servers of the companies and the users do not know where it is physically located. They are opened to all popular operation systems and devices, withouth obliging users to install additional software.

In Strategy for the effective application of informational and communicational technologies in education and science of Republic Bulgaria (2014-2020) it provides “a development of cloud informational and communicational technologies, infrastructures”. An adequate and modern managing vision suggests massive use of all of those trends to improve the state of informational and communicational technologies and to develop a normative base corresponding an innovative and technological changes in social development.

Judicious application of modern informational technologies is able to qualitatively change the process of developing education and science.

Examples:

- *digital books* with interactive plots of real life would much easier help to absorb a natural phenomenon of illustration only with formulas and schemes
- having an academic discussion online can help to break the stereotypes and the student and the teacher can free discuss and analyze problems
- the development of a modern platform for digital education can help the parents to have a view on what their children study and to be actively involved, and a common technology allows the teacher to do easier and successfully the science activity from their home and etc. [6].

Model of Web-based education for job development in technological education.

To create the Model of web-based job education in technological education (Figure 1) for beginning point it is used the model – The Learning Objects of learning. This model is based on the idea of “learning object” and as such type of object we can understand “every digital resource, which can be used twice to help the learning process” (Wiley 2000).

-Description of the model:

1. WEB 2.0 based education from mixed type, the learning content for job education is created as an interactive web-based resources which are used

to complement the technological education of the students. That way the students’ attention is engaged with the formal education as integrated in the trainning process those services /computers, tablets, phones/ which are used daily in the personal virtual space.

WEB-based learning resources for career education

Technological learning

WEB-BASED EDUCATION FOR CAREER EDUCATION IN TECHNOLOGICAL LEARNING Which uses cloud services that provides google education.

Figure.1 Model of web-based education for career education in technological learning

According to Web-based education for job education in technological education the students are learning in their own rate as communicating with teachers and between each other with e-mail, discussion groups, chats, social network. Those possibilities for interaction make web-based education for job education in technological education more adequate for electronical learning;

2. Web-based education for career education in technological learning which uses cloud services that provides Google education.

- *the Classroom service of Google* – with this service the teachers can easily organize the learning process in a comfortable electronical form, create and check tasks and works of the students, as automatically structure the files in folders and documents in cloud storage of Google Drive for comfortable access from everywhere. On the page of the task the students see what the task is and start to execute it immediately. The datas for its execution is refreshed in real time and the teacher can immediately start checking the works, evaluating and adding comments. There is a maintenance of individual tasks. With the Classroom cloud service the teacher can spread the messages and initialize discussions; the students – can exchange materials between them and answer questions from their teachers. In that moment Classroom service is available in 42 languages such as Bulgarian, and it is optimized to work with mobile devices and e-readers. To use the service on URL: classroom.google.com, there must be chosen the role (teacher ot student), after that there is the opportunity to create a new course or to join an existing one.

- *cloud service Google Apps* is a package of free tools which includes: Gmail, Calendar, Google Sites, Google Drive.

- *cloud service Google Apps* allows the cooperation and the communication, regardless of location and used.

- Google Drive is a virtual cloud to store which can be used to move files everywhere and to have access from every computer or new mobile device, which can move files comfortably for teachers and students.

- *Google Calendar* for tracing important dates and tasks which is always synchronized with the phone.

- *Blogger* is a system for blogs, a combination of software and services for the creation, the maintenance and the hosting of such. From educational point of view, blogs allow the cooperation between teachers and students, to share learning resources, to create content and to connect to general social media canals, such as YouTube, other blogs, tweets, social bookmarks and etc. All of them on one page (http://www.edudemic.com/best-web-tools/).

-*Google Sites* is a free platform to create web pages. It allows to create free web sites using offered templates. Users do not need to know the HTML language – there is a special created interface to create and edit web sites. The main advantage of Google Sites is accessibility – fully internet working withouth the need of additional software installing. To use only the main functions this service is free and every account has under 10 GB space [9].

IV. CONCLUSION

The offered model of web-based job education in technological education provides the possibility to the teacher to create different web-based resources for education, such as educational web sites, portals base of knowledge, systems for electronical education.

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LEARNING IN SOFTWARE PROCESS ASSESSMENT BASED ON FEEDBACK SESSIONS OUTPUTS

Z. Stojanov, D. Dobrilović
University of Novi Sad/Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
zeljko.stojanov@tfzr.rs, ddobrilo@tfzr.rs

Abstract - Software process assessment is an initial phase of software process improvement projects aimed at discovering the real state of software processes in the practice. Process assessment enables identification of strengths and weaknesses of investigated processes, which allows identification of potential improvements. In small software, companies dominate inductive assessment approaches, which are concerned with the real context and the state of the practice. These assessment approaches are tailored to specific needs of companies. Feedback is an essential technique in process assessment for communicating findings and comments between various stakeholders. It facilitates iterative assessments of selected processes, and organizational learning through identification of knowledge stored in the company. The use of feedback sessions in software process assessment, with the focus on organizational learning, is illustrated with the experiences in a local very small software company.

I. INTRODUCTION

Knowledge becomes necessary for survival and success of organizations in unpredictable contemporary market. This is especially true for software organizations that are highly dependent on new modern technologies and require highly skilled employees willing and capable to learn permanently while work. There exist two types of knowledge in workspace within organizations [1]: tacit and explicit. Tacit knowledge is practical, action-oriented knowledge grounded in everyday practice and personal experiences, which is not expressed in a way suitable for transferring. Explicit knowledge is tangible and can be stored, expressed and used easily within an organization. Explicit knowledge can be found in files, databases, documents and reports, software code and emails. Smith reported that over 90 percent of knowledge within organizations is located in peoples' heads [1].

Three main elements of knowledge in contemporary organizations are people, processes and technology, as it is presented in Fig. 1. Edwards [2] argued that the emphasis has been too strongly on people and technology, while the process element has been undervalued and insufficiently explored. This is somehow surprising since the competitive advantage of organizations depends mainly on their underlying business processes [3]. Initiatives related to processes' aspects of knowledge management are oriented towards new ways of working, which will increases business efficiency of an organization, as well as ensures better learning performance and management of knowledge.

Processes encapsulate the way organizations are doing business and reveal their values, priorities, and preferences. Effective and managed processes can lead to effective performances at the individual jobs level and at the organizational level. However, in many cases organization processes are not well defined or emerge from performed actions, which lead to poor and unsystematic implementation. An organization that uses weak or misdirected processes will have weak products or services, and unpredictable outcomes of business activities [4]. According to Rummler and Brache [5], the value of processes is misconstrued and misapplied if processes are not observed as a part of a larger organizational system. Process improvement as a long-term strategy should be aligned with overall business strategy and business performance objectives in an organization. A list of processes that should be assessed and improved can be derived from the business performance objectives [6]. For example, if the business performance

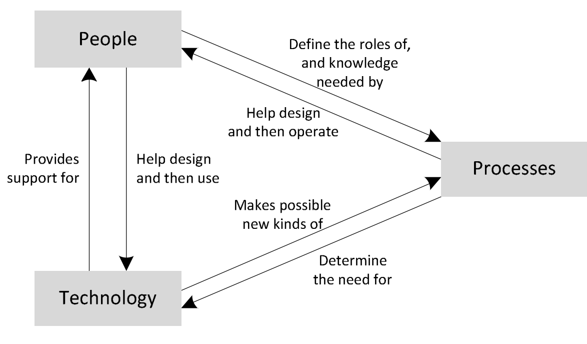

Figure 1. The main elements in knowledge management [3]

objective is to do faster and more reliable processing of user requests, the following processes should be assessed and improved: requirements process, product design and development processes, product release and delivery processes.

In order to effectively deal with requirements and expectations of market, software organizations need to continually assess and refine their processes [7]. For solving problems with poorly defined and implemented processes in software organizations, a number of approaches were proposed and shaped in Software Process Improvement (SPI) frameworks. The success of these SPI frameworks is influenced by several factors [8], critical barriers [9] and organizational culture [10]. According to Meehan and Richardson [11], learning and knowledge management are core to SPI models. Practically, information about processes are embedded in an organization and must be collected, refined and stored during process assessment and improvement activities, which clearly reflects learning and knowledge management activities. This knowledge about the processes becomes available to all employees in an organization. Making existing knowledge within a software organization explicit can make software processes more effective and moves the organizational maturity at the higher level [11].

Organizations' abilities to adapt and learn are crucial for their performance and long-term business success, which emphasizes the practical importance of organizational learning and knowledge. Theoretical and methodological aspects have been developed along with the practical aspects of organizational learning. Since organizational learning is continuous, cyclic and long-term process, methodological approaches for investigation include various methods such as case studies based on longitudinal data collected in the field, or development of simulation models and platforms [12]. Organizational learning is situated in an exact context, which includes the organization and the external environment. Structure, organizational culture, goals and strategies, technology and memory are characteristics of an organizational context that influence organizational learning. Knowledge is the result of interactions between the context and experience. According to Argote and Miron-Spektor [12], organizational learning processes enable conversion of task performance experience into knowledge through ongoing cycle. The process of learning from experience is not straightforward and easy comprehensible. Understanding of experience is usually a long road that requires collecting and analyzing experiential data, which will further lead to identification of relevant information. Identified or emerged information provide the basis for creating knowledge that becomes usable for individuals and organization.

It is widely accepted in research community that organizational learning represents a change in the organization's knowledge, which occurs as a function of accumulated experience in performed tasks [13]. Actually, learning occurs most frequently because of performing incomplete or unsuccessful tasks. Based on systematic assessment of strategic management literature, Fiol and Lyles provided the following definition [14]: "*Organizational learning means the process of improving actions through better knowledge and understanding*". Hence, organizational learning assumes the existence of improvement process related to activities in an organization, as well as knowledge and understanding required for this improvement. It means that based on the understanding of current activities and existed knowledge, processes can be improved, which will lead to increased understanding of the practice in an organization, and to broadened and deeper knowledge. In this context knowledge include declarative knowledge or facts, and procedural knowledge or skills and routines [13].

II. BACKGROUND

This paper deals with concepts such as learning, feedback and software process assessment, which form a complex field for understanding and researching. Accordingly, in the background section will be presented some recent trends and discussions in the fields such as feedback in organizational learning and learning in software process assessment.

A. Feedback in Organizational Learning

The concept of feedback originates in systems thinking and cybernetics. Feedback has been researched and used in education, management, marketing, professional training, human resource development, medicine and engineering. Due to the specificity of different fields, the term feedback is used and interpreted in different ways, which causes that there is no universally accepted definition of feedback. In researches about humans, the most common usage of the term feedback relates to the presentation of information to individuals regarding different aspects of performance, such as behavior or outcomes [15]. The complexity of feedback partly results from difficulties of adapting concepts from mechanical to human systems, and the fact that it is not possible to simplify human behavior in organizations [16].

Organization performances are affected by organizational routines and mechanisms, which are adapted and learned through the practice. Understanding mechanisms and routines that shape business activities within an organization is necessary for effective organizational learning [17]. According to Mausolff [18], organizational processes are the primary source of learning in an organization, while feedback helps in initiating and sustaining organizational learning. The purposes of feedback in organizational learning is to provide information on actual implementation and performance of processes and activities (identification of strengths and weaknesses), which encouraged critical reflections of involved people in order to guide further activities that will improve practice. Context based learning in organizations is usually based on direct experiences and depends on several factors, among which feedback takes significant role [13].

B. Learning in Software Process Assessment

Identification of critical problems and improvement opportunities are the main goals of process assessment, which allow organizations to improve themselves. The assessment procedure consists of the following phases: planning, executing, completing the assessment, and providing feedback. Feedback is provided to people in organization that is involved in the assessment. Process assessment is the initial phase in SPI cycle, and its outcomes are inputs for process improvement action plans.

Software process assessment includes feedback as a core activity, which is usually a part of a typical sequence of activities [19]. Feedback is a valuable method for learning in a software organization based on the previous experience and identified issues in the assessment process. Software process assessment and improvement facilitate organizational learning if all relevant information and knowledge are communicated to members of an organization [20]. Feedback can be used for collecting experiences from organizations participating in assessment projects, and developing and systematizing knowledge. This knowledge can be used for providing recommendation for these organizations in future projects, and for improving assessment methods [21].

III. EXPERIENCE FROM THE PRACTICE

In a selected small software company, organizational learning has been recognized as important factor for practice improvement, but organizational support and systematic approach have not been applied until the implementation of software process improvement project started in 2011. The project aims at improving software maintenance processes and developing a suitable model for supporting organizational learning. Before starting the project, organizational learning happened as a result of the everyday practice, which led to poor and unsystematic knowledge management practice. Learning process can be rather classified as improvised than planned.

In the following subsections, context issues necessary for understanding the process assessment and organizational learning approaches, process assessment approach, and an inductive learning approach based on frequent feedback sessions are outlined.

A. The Context

Research was situated in a local very small software company oriented towards local clients in Serbia. The company develops and maintains over 30 software products for over 100 client organizations. Evidence from the repository of client requests and associated tasks revealed that over 84 percent of tasks are related to maintenance activities [22], which justifies the need for implementing the SPI project related to software maintenance processes. The employees in the company and researchers from university jointly implement the project since 2011, and it is still active.

The core of the company team is three developers, each of them with over 15 years of experience in software industry. They have the largest contribution to company development and implementation of SPI project. During the project implementation, one employee left the company, while all other six employees participate in SPI project and regularly contributed in feedback sessions. This stability and homogeneity of the team in the company positively effects learning processes, which has been recognized as important success factor in literature [23].

B. Process Assessment

Process assessment is realized as a part of a SPI project. For the assessment of software maintenance processes, a lightweight and participative assessment approach called *Lightweight method for Maintenance Process Assessment based on Frequent Feedbacks - LMPAF*[2] was developed. The approach was tailored for the company, but can be also implemented in similar small software organizations. It is designed for small software companies, which means that it starts from the enterprise organization, assumes the active participation of employees, and do not interfere with everyday activities in the company. Therefore, the approach can be classified as inductive. Based on the identified processes' capabilities, and the priorities of the company, the implementation of the proposed improvements is carried out. The main characteristic of inductive approaches is that proposed improvements are related to the most critical process areas in an organization, which promotes active learning during assessment.

LMPAF^2 approach is implemented as iterative process that includes data collecting activities, data analysis activities, preparing material for feedback sessions, conducting feedback sessions, analysis of outputs from feedback sessions, and defining and prioritizing process improvement proposals.

The process is iterative as can be seen in Fig. 2. Assessment approach includes several loops with data collecting and analyzing activities and feedback sessions, which is determined with identification of improvement proposals that fulfill expectations of company management and employees. These expectations of SPI project are identified in process improvement plans. Frequent feedback sessions enable step by step monitoring of progress. If process potential improvements are not well defined during the session, new acquisition and analysis of data are required, which initiate a new iteration in assessment process.

The assessment approach is mainly based on data analysis and discussions during feedback sessions. Feedback sessions are realized as working meetings in the company, with participation of employees and researchers from university. Each session is moderated by a leading researcher, whose role (*Process Improvement Project Operations Manager*) is defined during the establishment of infrastructure for conducting the SPI project [24]. The aims of these sessions are exchange of information between all employees and researchers, and feeding back information to employees about the assessment activities, which will help in further decisions during assessment [25]. Exchange and systematization of information during feedback sessions allow learning within the company, and better understanding of the practice, which positively effects performances of activities in the company [19][26].

C. Learning from Feedback Sessions Outputs

Learning in *LMPAF*^{2} is based on collecting experiences from employees during feedback sessions and developing knowledge about the practice based on that experience. Practically, observation of practice and interviews with the employees, studying company documents, and records extracted from the company internal repository provide the evidence on how employees work on everyday tasks. This evidence covers skills or tacit knowledge that is in people's minds. Through assessment activities, and especially through feedback sessions, this knowledge is refined and systematized. The process of identifying the knowledge about usual activities, followed with generalizations about activities are the basis of inductive learning approach implemented during assessment of maintenance processes. In this way, knowledge is inductively derived from the facts about the practice [27], and become explicit knowledge available to all employees in the company.

The primary condition for learning through process assessment project is organizational support in providing appropriate setting (meeting

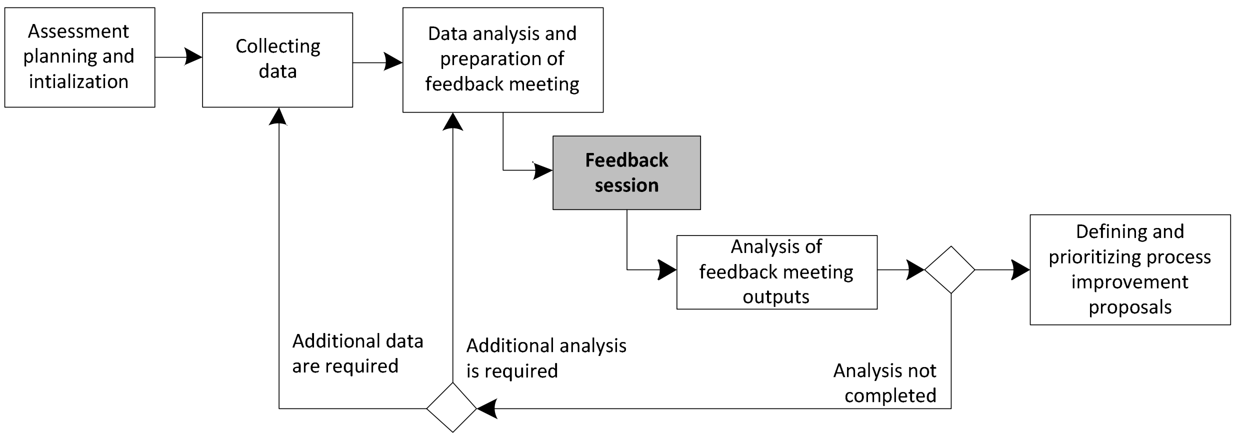

Figure 2. Process assessment approach based on frequent feedback sessions

room) within the company for the sessions, and in motivating employees to participate actively in the whole assessment process. In sessions participated:

- *Employees*. They provide comments on data about the investigated segment of the practice in the company, and discuss discovered process capabilities and proposed improvements.
- *Moderator* (*leading researcher*). He prepares the agenda and material for session, announces the session to all relevant employees and researchers, moderates session, and facilitates discussion.
- *Researchers*. They prepare material with analyzed data for session, provide justification for used methods, and discuss discovered process capabilities (strengths and weaknesses) and proposed improvements.

Through examination of results of data analysis, collected feedback during sessions and analysis of previous decisions during assessment process, employees gain experience, which is interpreted and developed into explicit knowledge available to all employees in the company. This explicit knowledge can be used for improvement of daily activities and decision making in the company. Thematic analysis of output documents from feedback sessions is used for development of explicit knowledge about the investigated segment of practice in the company (see Fig. 3). Thematic analysis is inductive method for qualitative data analysis [28][29], which enables identification of important themes in documents, their relationships, and integration into a thematic framework that encompasses discovered and systematized knowledge. Identified themes are related to software maintenance processes, managing maintenance requests from clients, roles of people in maintenance request process, tools and techniques for solving specific tasks in maintenance request processing, and organizational issues related to software maintenance activities. These emerged themes and their relationships comprise systematized knowledge about the maintenance processes in the company.

Thematic framework was developed by the researchers through implementation of thematic analysis methods, and validated by employees in the company.

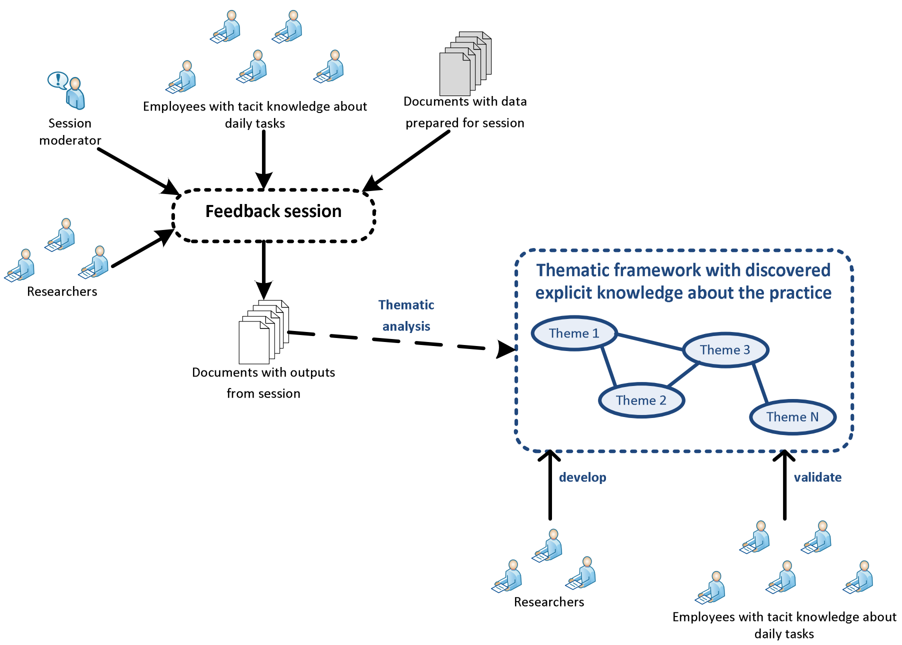

Figure 3. Learning based on analyzing output documents from feedback sessions

IV. CONCLUSIONS

Small software companies should assess and improve their processes in order to survive at turbulent market. However, it is not enough only to improve processes, it is advisable to facilitate and promote learning as continuous engagement of all employees. The learning includes extraction of knowledge from past experience, and effective implementation in future projects.

Positive experience with process assessment project that promotes organizational learning in a local small software company is presented in this paper. Process assessment and learning are based on frequent feedback sessions conducted in the company. The output documents from feedback sessions are used for development of thematic framework with extracted knowledge about practice. This knowledge become available for all developers in the company, can be updated and refined, and used in future projects.

Further work will include development of a software tool for effective management of knowledge structured in thematic frameworks, and implementation of this approach in other small software companies in order to assess its usefulness.

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VIRTUAL-REALITY, ITS TECHNOLOGIES AND THEIR POSSIBLE IMPACT TO EDUCATION OF HANDICAPPED PEOPLE

B. Sobota, Š. Korečko, F. Hrozek, C. Szabó, L. Jacho
Department of Computers and Informatics, Faculty of Electrical Engineering and Informatics, Technical University of Košice, Letná 9, 041 20 Košice, Republic of Slovakia
branislav.sobota@tuke.sk, stefan.korecko@tuke.sk, frantisek.hrozek@tuke.sk, csaba.szabo@tuke.sk, ladislav jacho@tuke.sk

Abstract - The paper deals with virtual reality (VR) technologies in the context of their impact to education of handicapped people in the modern information society. It describes a VR workplace created for experiments in this area at the home institution of the authors and related technologies. It primarily focuses on outputs and results of research and other projects in the laboratory LIRKIS (part of the authors' institution). Possible consequences of utilization of these technologies in the education of handicapped people are discussed, too. In this context, we prefer hearing impaired and cognitive handicapped people over visually and motion impaired people.

I. Introduction

A virtual-reality (VR) system is an interactive computer system that is capable of creating an illusion of physical presence in an imaginary or real world [1]. It is also used for simulations in tightly coupled human-computer interaction environments (HCI, Human Computer Interaction [2]). When compared with other computer-based systems, VR systems are more interactive but, on the other hand, the cost of their implementation is higher. Each VR system can be seen as 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. It the rest of the paper we overview research and development results, achieved in this area by the authors ant others. The next section introduces VR laboratory LIRKIS (Laboratory of Intelligent Interfaces of Communication and Information Systems) where some of these results have been achieved. Section II describes the results and discusses other possibilities of VR technologies utilization for corresponding handicaps. More detailed description of selected results can be found in [3],[4],[5],[6],[7].

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II. VR Laboratory LIRKIS

The basic principle of the virtual-reality system operation as used in the LIRKIS laboratory is shown in **Error! Reference source not found.**: users interact with the VR system via its input and output subsystems while the system itself runs on a computer cluster.

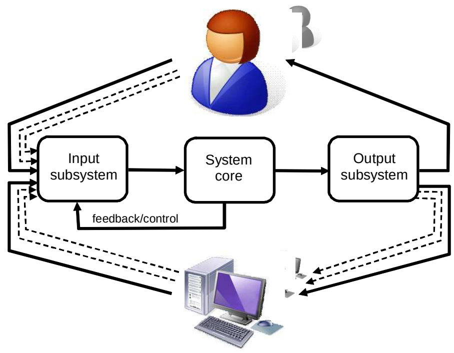

Figure 1. Basic VR system workflow

The primary task is visualization and the laboratory provides several devices for it, such as autostereoscopic 3D display Philips WOWvx, which does not require glasses to watch or projection system based on an interference filter technology. The system provides 3D visualization of objects, which can be manipulated interactively by means of several motion tracking sensors. The data flow between individual components of the system is illustrated in Figure 1.

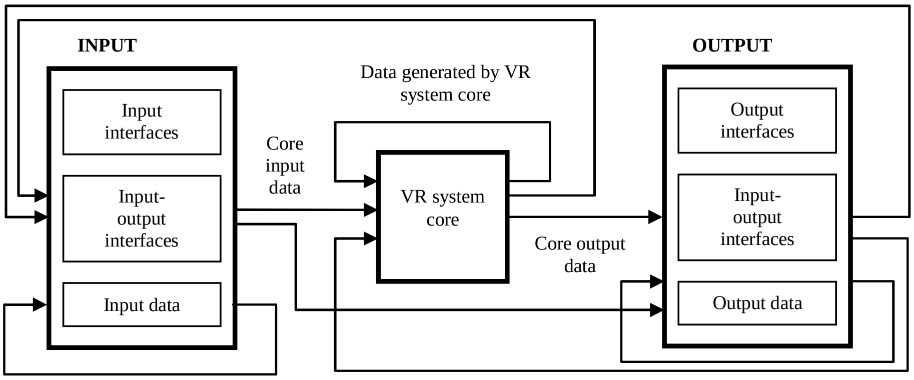

Figure 1. Data flow between VR system core and peripheries

Various devices can be used to acquire information about position and movements of the user. These devices can be mechanical, magnetic, ultrasound, optical or inertial. It is optimal to use contactless motion tracking devices, such as MS Kinect or InterSense IS-900. The IS-900 provides precise tracking thanks to its six degrees of freedom. Both devices are available in the LIRKIS lab. To capture precisely hand movements, data gloves are used. The laboratory provides two types of gloves, one of them is a prototype developed at LIRKIS. The overall layout of the laboratory can be seen in Figure 2. The lab also contains a 3D printer, which is used to produce real objects from developed 3D models.

III. VR Technologies for Handicapped Persons

Handicapped information and communication technologies users are not only users with physical or sensory disabilities but also cognitively impaired ones (e.g. users with learning disabilities or concentration problems). So, VR technologies will be primarily used to create a natural user interface 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:
  - hearing impairment,
  - visual impairment,
  - other sensory impairments (e.g. olfactory and gustatory impairment),
- Intellectual disability (e.g. caused by the Down syndrome),
- Speech disorders (i.e. decreased ability to communicate by speech),
- Emotional and behavioral disabilities,
- Learning disabilities (reading disorder, disorder of written expression, math

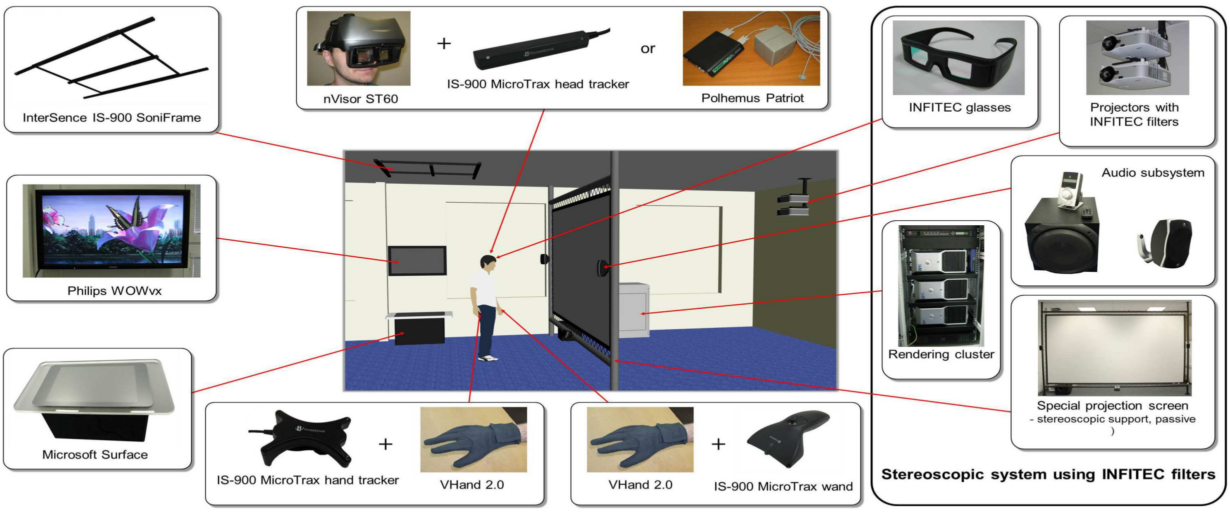

Figure 2. LIRKIS laboratory layout and equipment

disability, etc.),

- Other disabilities (different kinds of addictions, senility, etc.).

Approximately 650 million people live with a disability worldwide nowadays (10% to 20% per country). Disabilities are more common in developing countries and likelihood of disability increases with age. Impaired people need to use supporting technologies to work with computers [8], mainly alternative user interface tools such as readers (text to speech software) or screen magnifiers. According to [9] information and communication technologies can help impaired people primarily in the following areas:

- 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.

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. Visually Impaired and Blind People

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) [10]. 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.

B. Hearing Impaired and Deaf People

Hearing disability limits 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 or
- EEG scanners.

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; however, size and price of these sensors limits its usability.

Muscle tension sensors, such as MYO, 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. Both these technologies will be a subject of future research and development activities at LIRKIS lab.

C. Physically Disabled People

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 [11]. 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 consists 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 particular 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 [12]. Considering other VR technologies, we can also utilize 3D printers, which can be used to print various aids, such as prostheses [13].

D. Cognitively Impaired People

Cognitively impaired persons have problems with solving one or multiple types of mental tasks [14]. 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 label, caption or a navigation element. The structure of the interface should be expressed visually (i.e. using various font types and sizes) and semantically. 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. An interactive school desk has been developed at LIRKIS, which uses a 24-inch touch screen LCD. The desk was used in education of children with multiple handicaps, including cognitive, and the size of the display has been found sufficient. Suitability of smaller displays, on tablets, is currently under examination. The examination will also test durability of these devices for education of handicapped children.

IV. CONCLUSION

Virtual reality and its technologies represent a relatively young but perspective area. It is also one of the fastest developing disciplines of informatics and information technologies. 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. With further development of applications such as the ones presented in this paper, VR technologies can significantly contribute to integration of handicapped people into the society.

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DEVELOPMENT AND INFLUENCE OF IT ON TEACHING ENGLISH

V. Cvetković, T. Petković, E. Tobolka
University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
cvetkovic.vladislava@gmail.com, ptamara0210@gmail.com, tobolka@eunet.rs

Abstract - Teaching in modern education is under the increased influence of information technology, which indicates the endeavor to modernize the educational process, and not only to use modern teaching resources into everyday teaching, but to make it a part of it. The uses of computers, software and the Internet in teaching the English language are steadily rising. Additionally, learning culture in English is becoming a standard element of most educational programs, which gives a dynamic approach in preparing the students for the global labor market, making them more culturally competent. Furthermore, this teaching technique provides students with the opportunity to improve their ability in developing cultural hypothesis while confirming their validity using Web Sites and software.

I. INTRODUCTION

The continuous development of science and technology led to the point where information technologies became a core part of all aspects of life. Through the use of multimedia technologies, students have a far easier time in learning the new material. A large number of studies confirmed the thesis that memory traces exist far longer if new knowledge is acquired through multiple perceptual experiences that the student has during classes.

The process of teaching English is one of the first in which there has been a significant shift in introducing new teaching resources. Through the use of cards and audio-video material (tapes, CD, DVD) has begun an effort to modernize the teaching process, and thanks to the development of information and communication technologies and their introduction into schools, new approaches in teaching have been enabled. The acquisition of the four fundamental skills while learning a foreign language (reading, writing, listening and speaking), is made far easier with the use of appropriate teaching software, and through the use of the Internet, the student's knowledge gets a whole new dimension in terms of understanding not only the language but also the culture of speaking areas where the language is spoken.

II. EDUCATIONAL SOFTWARE FOR LEARNING THE ENGLISH LANGUAGE

The software that is used while learning a foreign language in higher grades is called "*Tell Me More*" in different variations for the appropriate language. This application is far more advanced because the content is adapted for different levels of knowledge. One of the fundamental benefits of this software is the use of technologies for voice recognition and automatic correction of errors that the student makes. It also has 3D animations that show the correct position of the mouth and lips to correctly pronounce certain words. This way, there is a far higher interactivity between the students and the computer.

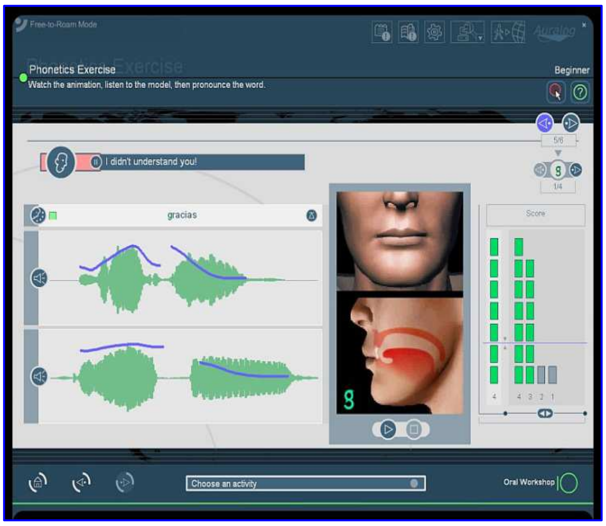

Figure 1: The applications appearance

In lower grades of elementary school, in English Language classes, the teacher uses an application called "*Word Bird's Word Land*" which was created with a goal for students to expand their vocabulary in all areas of life in a fun way. Through games, children learn to use new teams in everyday speech in a fun and interesting way. Satisfying the didactic principle, *adaptation of age systematization and gradualness and individualization and socialization*, the software enables an active class through whom the student sets himself in the heart of the process and actively participates in class. As an example of use of the software we can take a class of English language in the third grade of elementary school on the subject of "Food": the teacher begins his lecture with a demonstrative method using cards, and in the main part of the class, he uses either group or individual form of work on the computer. The student through games and interesting animation individually adopts new vocabulary. In the last segment of class, the students affirm their newly acquired knowledge and practice writing.

Using these software applications in teaching, the students have an easier time in learning new vocabulary and are ready to use it in speaking and writing next time in class. But why does it come to this? Multimedia class has a big influence on the student's positive motivation – that which awakens their interests, and, in a fun way, requires the students to use their skills and previously acquired knowledge in adopting new teaching material. The teacher acts as a mediator between the student and the computer, his role is to guide the students, to encourage them, and not to just merely reproduce the newly acquired knowledge.

The student's motivation during this kind of work is extremely high, and with it the amount of knowledge the students acquire is also very high. An interesting fact is that the students with weaker abilities can also achieve satisfying results and can use the newly acquired knowledge later down the line. Of course a significant effort has to be put in so that this way of teaching becomes an integral part of every class, but we must not forget the role the teacher plays in the teaching process as a good organizer, and must show his humanity when working with the students. Combining these two aspects gets the best results.

III. The Use Of Web Sites In Teaching English

The use of the Internet in class, presents a new teaching technology that provides a huge motivational influence on students. The Internet is something with which the students are already familiar, they use it every day at home for a variety of reasons and uses, so its use in the classrooms serves as a way for students to expand their knowledge and perspective concerning the teaching of a foreign language. Many web sites are created with interactivity in mind, through which students can learn and practice their grammar and vocabulary, but they can also be used as a way of introducing the students to new cultures and their language.

As an example of its use, we can take an English class of higher grades of elementary school where students are affirming a grammar unit that was learnt before. The students use a web site where they can practice their grammar, and complete various tasks and test that include different grammar units from all aspects of English.

The role of the teacher is to prepare the students for solving the tests, and after completing it, begin the discussion on the results and the acquired knowledge. This way, the teacher's work is made easier, and the student's motivation is increased, and therefore making an active class. Web sites are also used for cultural purposes, with which learning gains a whole new dimension. Namely, the students familiarize themselves with the culture, traditions and customs of the people whose language they study, which can serve as a very good incentive for understanding the meaningfulness of the teaching material they are learning. For an example, when the students mention a city that is located in an English speaking area or an English custom, it is certainly of great benefit to seek more information about this from the Internet. This type of work can be in a form of homework, but it can also be use effectively in classes in higher grades. On web sites, students can find official presentations of cities, their characteristics, and structures that are hallmarks of given cities. Using this approach, the students' awareness about the elements of English culture is affected, emphasizing that students should be pointed to the differences between the culture of our country and countries of the English-speaking world.

Students can also familiarize themselves, through the use of web sites, with the worlds well known newspapers and magazines, which not only have a lot of pictures, but also a large amount of audio and video material, which they can use to discus about the given topics in written form.

Information technology is constantly evolving and should be used not only as authentic material, but also for the purpose of various forms of communication. Using multimedia concepts, students gather information and material which they can use in their discussions on the subject of a given city or any other segment of culture. They themselves will try to express their views, their understanding of the country and the language they study.

IV. Online Courses For Independent Learning English

Independent learning English is simple and complicated at the same time. It is necessary to properly organize courses, choose the appropriate technique to find good books and dictionaries. English courses with the help of the Internet allow raising the level of knowledge and faith in you because everyone likes to master new skill without assistance. It is well known that understanding by listening plays a key role in learning a foreign language. If the Web sites are well selected and organized, it can be offered many opportunities for the adoption of the English language through the development of skills by listening and talking in a cheerful and pleasant context. One of these sites is the site "ABA English" that allows you communication with teachers whose primary language is English. With the help of interesting video lessons, children and adults develop the skills of listening, pronouncing and understanding English language and eventually resulting in a certificate confirming their knowledge.

Figure 2: ABA english-Course Unit

V. CONCLUSION

Using information technologies, students are given valuable information for studying a language and culture. The introduction of new teaching methods and techniques, increases the students' motivation and the acquired knowledge as well. It also gives them access to culturally authentic materials that they otherwise would not be able to experience. What is more important is that it allows them to develop their own cultural understanding which confirms that thesis "understanding a culture is a dynamic process in which students are constantly connecting their cultural background knowledge to the current experiences in order to create a sense of meaningfulness "(Robinson). Students learn to accept differences in cultures and they will integrate some parts of it into their lives.

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DEVELOPMENT AND EVALUATION OF A 3D VIRTUAL TUTOR FOR MACEDONIAN SIGN LANGUAGE

S. Koceski, N. Koceska
Faculty of Computer Science, University Goce Delcev – Stip, Republic of Macedonia
saso.koceski@ugd.edu.mk, natasa.koceska@ugd.edu.mk

Abstract - According to the National association of deaf and hard of hearing of Macedonia, there are around six thousand deaf persons, and they are representing about 0.3% of the total population. According to the reports of the same association, there are two schools for deaf children and only twelve certified sign language interpreters at national level. Considering also the fact that 90% of deaf children are born to hearing parents who may not know sign language or have low levels of proficiency with sign language, it is evident that there is a huge problem in education of deaf children. They necessitate permanent access to education tools even at home in order to develop language skills. For this purposes we have developed 3D virtual tutor for Macedonian Sign Language (MSL) using Java programming language, compatible with desktop computers and mobile devices. It is composed of two modules: module for learning the alphabet and module for learning individual words. This software was evaluated by two categories of users: deaf persons, and non-deaf persons. The results of this evaluation are reported in the paper.

I. INTRODUCTION

Deafness is a term used to cover the whole range of hearing loss from mild to profound. The level of deafness is defined according to the quietest sound, measured in decibels that a person can hear. According to Macedonian law, a deaf person is considered a person with hearing impairment above 80 decibels and is unable to hear sounds even when a sound is amplified. First or preferred language of this category of people is a sign language. It is a non-verbal language used by deaf and hard of hearing people as a primary natural means of everyday communication and mutual intercourse. Information is conveyed visually, using a combination of manual and non-manual means of expressions. The manual parameters are hand shape, hand posture, hand location and hand motion. The non-manual parameters include head and body movements, facial expression, and lips movement.

The grammar of the sign language differs from the spoken one. The structure in spoken language is linear, one word followed by another, whereas in sign language, a simultaneous structure exists with a parallel temporal and spatial configuration.

The hand is an essential tool, which is used in communication with sign language. Characters are represented in a particular movement and a certain set of one or both hands.

However, not any gesture has a meaning. The significance of the sign is determined with the basic elements that need to be taken:

- The placement of hand - positioning of the fingers of the hand or both hands
- Movement of the hand or both hands
- Position-location of the sign in sign space
- Orientation of the palm of the hand.

Sign language is not universal, it differ from country to county. Unlike the bigger countries that pay great attention to this category of people, in Macedonia unfortunately this community is highly marginalized. According to the National association of deaf and hard of hearing of Macedonia, there are around 6000 deaf people deaf persons, which represent about 0.3% of the total population, and only 12 licensed interpreters of the Macedonian Sign Language (MSL) [1]. It is very difficult to find the suitable materials for learning the MSL. There are no e-books, videos or any other type of online content that can help learning the MSL, which is very important in the era of digitalization. Moreover, there are only two schools for deaf children in Macedonia, so when a deaf child is born by non-deaf parents, the learning of the sign language represents a real challenge that affects the whole family. This is the reason why we decided to develop 3D virtual tutor for Macedonian Sign Language. In this way we want to contribute, and at same time to highlight the importance of learning the MSL, which will facilitate social integration of this category of people.

II. MACEDONIAN Sign LANGUAGE (MSL)

The Macedonian sign language is based on hand and body gestures, as all the other sign languages. The hands are the basic communication means. The signs are performed with predefined movement and location using one or both hands.

The Macedonian sign alphabet consists of 31 signs, the same number of letters that Macedonian alphabet have. There are two versions of the alphabet: one version is signed using only one hand and the other is using both hands. Figure 1 shows the MSL alphabet signed with one hand, while Figure 2 shows the MSL alphabet signed with two hands.

MSL vocabulary is estimated to be around 2800 signs, including the alphabet.

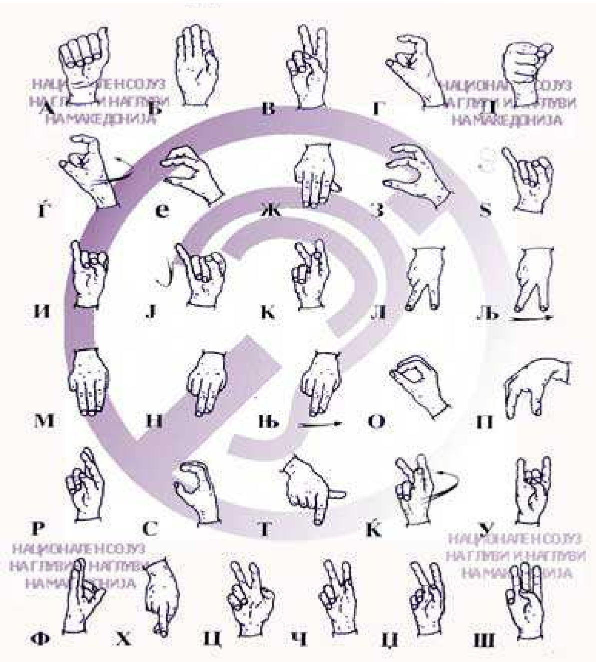

Figure 1. MSL alphabet signed with one hand.

III. RELATED WORK

One of the key components of any sign language training resource is presentation of the signs themselves. The possible presentation styles usually are in-person, print-based, videotape, and computer/CD-based.

Today with the rapid technology development a new ways of learning sign language appeared. There are research groups, which are focusing their research on improving communication using the visual technologies to translate sing language into text with devices like mobile phones, such as Mobile Motion Gesture Design for Deaf People [2]. Other research groups are converting text [3] or audio into sign languages. Such examples include Mobile Multimedia Application for Deaf Users [4] and the Lip Assistant [5] that translates the audio signal into animated face so the deaf users can use lip-reading. Another direction of research concentrates on the learning process of the sign languages. Examples of this type of research are the System for Sign Language Tutoring [6], which evaluates users' signing and gives multimodal feedback to help improve signing, 3D Animation Editor and Display Sign Language System for Thai Sign Language [7] - for learning a deaf person with Thai Sign Language and SignOn - a Model for Teaching Written Language to Deaf People [8]. There are also some commercial products on the market like Vcom3D Sign Smith products, which use avatar for signing the American SL. They offer the products like Illustrated Dictionary, Studio, ASL and Signing Science Dictionary [9].

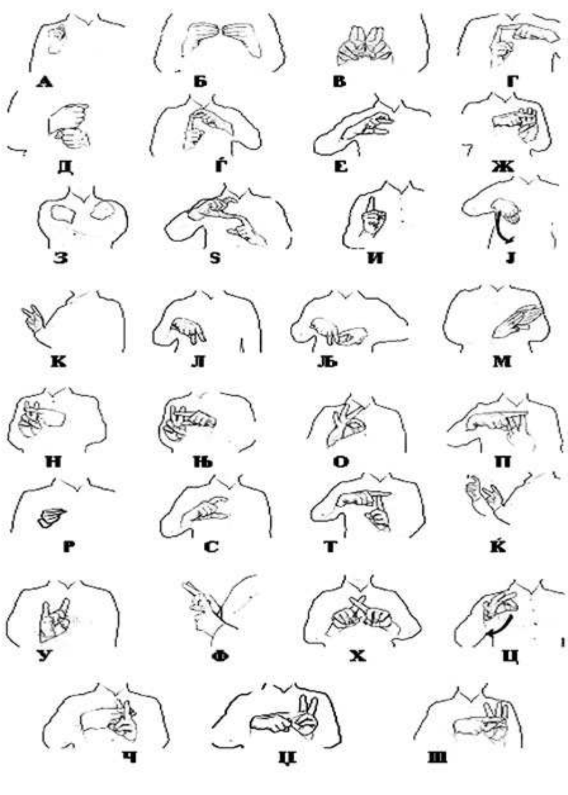

Figure 2. MSL alphabet signed with two hands.

IV. 3D VIRTUAL TUTOR

Learning sign language presents significant challenge especially to hearing people due, in part, to the difference in language modality, visual vs. aural [10]. The hearing sign language learner must shift from “listening for language” to “looking for language”. Hearing people, when learning sign language, have much more difficulty recognizing signs than producing them [11]. Therefore, the opportunities to practice sign recognition are a necessity.

3D virtual tutor for Macedonian Sign Language is developed to help non-deaf persons to learn the sign language. Developed using Java programming language, this application is compatible with desktop computers and mobile devices. The current application is composed of two modules: module for learning the alphabet and module for learning individual words. Module for writing sentences is intended to develop in the future.

Figure 3 shows the user interface design of a developed application. It consist of two part, one is for selecting a category for learning signs, and the other part is reserved for a 3D animations of a girl (avatar) that signs the chosen alphabet character or word.

First, user should select a category – letters or words. If a letter category is selected, a list of all letters from Macedonian alphabet is displayed. The user should select one letter, and the avatar will present this letter using a sign language.

The words category is divided in several subcategories containing words used in everyday situations. When a user selects a words category, he/she should also select sub-categories, like relations between people, food/beverage, feelings, seasons, travel/transport, sports/entertainment, professions, object etc.

Then a user should select a particular word from this sub-category, and the avatar will show this word using a sign language.

Figure 3. User interface of 3D virtual tutor for MSL

V. EVALUATION AND RESULTS

To evaluate the effectiveness of our work, we have conducted two user tests: a test with the deaf persons (who know the sign language and who used it in everyday life), and a test with non-deaf persons (who did not know the language and who want to learn it).

Since MSL is a visual language, it is particularly important for performed animations to be visually realistic, recognizable, and comprehensible. Because of this, we have conducted the test with the 7 deaf participants, who used frequently the MSL. Animations showing different signs (letters or words) were presented to the participants. Max. number of presentation for each sign was 3 times. Participants were asked to rate each animation on a 10-point Lickert scales for understandability, naturalness of movement, and grammatical correctness. These three categories were chosen because we believe that the understandability of the animation is a key criterion, and that the grammatical correctness and naturalness are factors that can contribute to the understandability. This can help to identify possible problems in the animation portion of the system, and will help us for its refinement.

Participants were given instructions about how to respond to each of the survey question. For grammaticality, they were told that “perfect MSL grammar” would be a 10, but “unacceptable/mixed-up” grammar should be a 1. For understandability, they were told that “easy to understand” signs should be a 10, but “confusing/mixed” signs should be a 1. For naturalness, they were told that animations in which the signer moved “smoothly, like a real person” should be a 10, but animations in which the signer moved in a non-natural manner “like a robot” should be a 1.

Participants were also told to write down each sign that was presented, as they understood it.

The results of this test are shown on Figure 4.

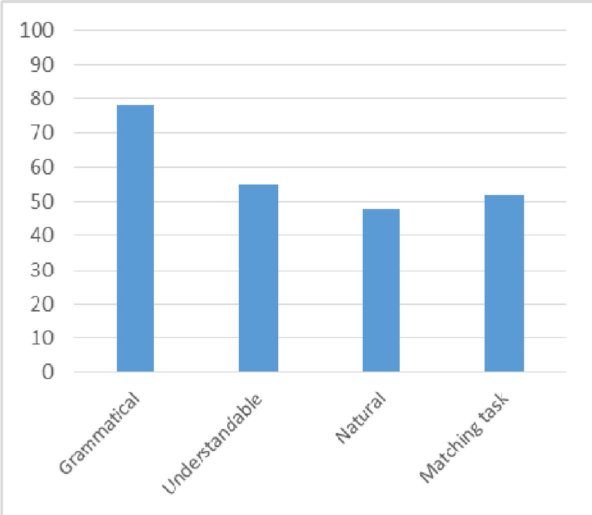

Figure 4. Results from evaluation with deaf participants.

Having in mind those comprehensibility levels of the currently evaluated avatars regarding the sign language is 58-62%, with only a single study reporting 71% [12]; the 51% of matching task in our test is considered a relatively good. This gives us confidence that our overall approach is effective. However, the animations still need improvements to obtain a more natural and grammatically correct movement of the animated person. The animation speed should be corrected, as almost all of participants said that some animations were very slow. Most improvements should be done on non-manual parameters: head and body movements, facial expression, and lips movement. Body movement should seem more loose/relaxed and should move more naturally in order to correspond to the specific sign. A facial expression and mouse movement should be integrated too.

The second test was conducted with non-deaf participants who did not know the sign language. The purpose of this test was to evaluate the effectiveness of our application as a learning tool, for people who wanted to learn MSL. The evaluation includes two phases: first was the learning phase and the second was the testing phase.

During the learning phase, ten participants (ages 30 to 50) have been given the opportunity to learn and practice MSL from a predefined library. They have been used the developed application, for one month, after which the testing phase was conducted.

During the testing phase, participants were shown animations of signs from a set of signs that were studied during the learning phase. They were told to select which of the three choices that were given to them on paper, matched the sign presented with the animation.

The results of this test are shown on Figure 5a and on Figure 5b (presented results show only a limited number of letters and words).

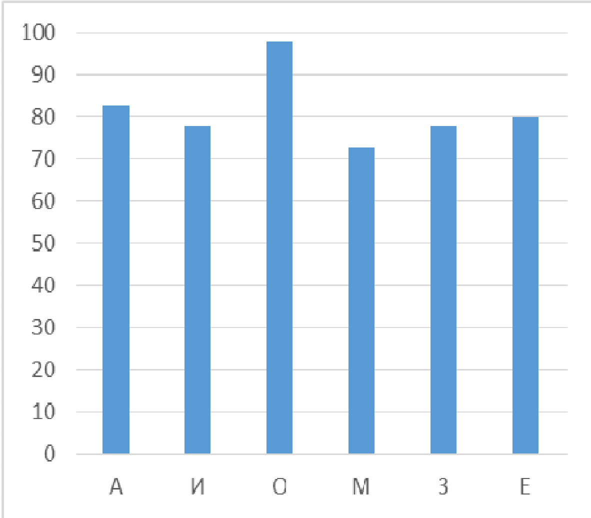

Figure 5. Results from evaluation with non-deaf participants - learning letters.

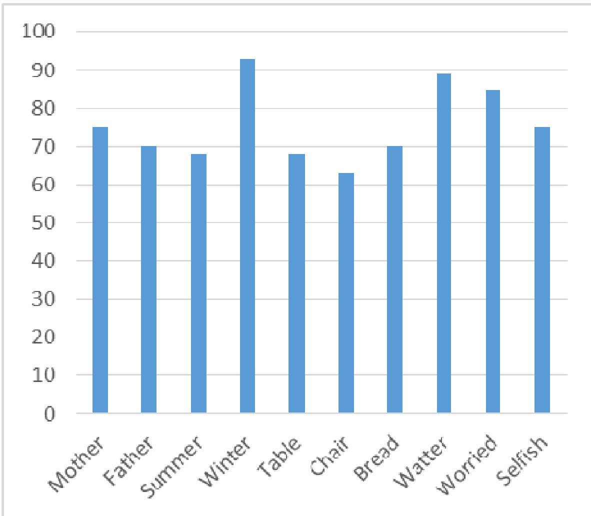

Figure 6. Results from evaluation with non-deaf participants - learning words.

The results have shown high recognition rate by non-deaf users, which mean that this type of application can be used as a tool for learning the MSL. Of course, the results in this test are very subjective since they depend on learning capacities of each person.

VI. CONCLUSION

The use of IT tools for learning sign language is not new. However, using signing avatars is a relatively young research area, with only a few ongoing projects for learning the MSL. With this research, we want to give a contribution to this new field, developing a 3D virtual tutor for MSL using Java programming language. The effectiveness of the developed application was tested with deaf persons, who have been used the sign language frequently, and non-deaf persons, who used the developed application for learning the sign language.

Results have been shown a relatively good recognition rate by the two categories of users gives us confidence that our overall approach is effective. However, the animations still need improvements to obtain a more natural and grammatically correct movement of the animated person.

A positive opinion, about this kind of applications, expressed by all participants, is encouraging and gives us an additional stimulation for further work.

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FUZZY SCREENING METHOD AS A COMPUTERIZED SUPPORT FOR DECISION MAKING

N. Tešić, D. Glušac, D. Karuović, D. Milanov, E. Terek, I. Palinkaš
University of Novi Sad, Technical faculty „Mihajlo Pupin“, Zrenjanin, Republic of Serbia
ntesic91@hotmail.com

Abstract - We live in the age of information and digital economy. It is based on knowledge, innovation, information, new business models, economic regionalization and global competition. Business systems are also required to be able to adapt rapidly to new trends and requirements of customers, in order to maintain competitiveness, their survival in the market and to make a profit, which is the ultimate goal of any business system. This paper describes fuzzy screening method as one of the decision support techniques used to improve business, make better decisions and successfully manage that system.

I. INTRODUCTION

The dynamics of the market, openness and competitiveness in the business environment, enhance the complexity of the decision-making process, as well as business management system, and management of business systems require new and faster methods of market research, access to the data, converting these data into information useful for business, and later to knowledge too.

In all present approaches in modern management theory, the decision-making implies a rational choice from a set of available alternatives (actions). [1]

With the rapid development of information and communication technologies in the second half of the twentieth century, decision-making process is not automated (decision still has to be made by a man), but is greatly facilitated by the development of information systems for decision support.

Application of modern information and communication technologies in business, gives business systems the opportunity to improve, make better decisions and sucessfuly manage that system, since today the business system requires rapid adaptation to new trends and requirements of customers, in order to maintain competitiveness, their survival, growth and development.

Information System (IS) can be defined as arranged set of methods, processes and operations for collecting, storing, processing, transmission and distribution of data within an organization, including equipment which is used for such purposes, and the people who carry out these activities.

The information system is a system where information are on entry and exit. Within the business system, the transformation of input into output values is being made.

Based on the goal that should be achieved, information systems can be:

- Operational information systems (used for solving structured problems);
- Expert Systems, allow the use of large amounts of data registered in databases and knowledge bases;
- Management Information Systems, oriented to providing support to governance and management in business systems;
- Decision Support Systems-DSS, provide managers and others with useful information that they need in everyday management decision-making;
- Hybrid systems formed by integrating two or more different types of information systems.

This paper will present a more detailed characteristics of the decision support information system.

II. DECISION SUPPORT SYSTEMS

Decision Support Systems (DSS) are interactive, flexible and adaptive computer information systems for support in solving unstructured business problems, in order to improve the decision-making process, and building on a number of different disciplines - in the first place of management and information technology.

Decision support systems are information systems that need to support business decision-making processes and represent a blend of information systems, implementation of the series of functional knowledge and decision-making. These systems should provide the manager with accurate, timely and relevant information.

Decision support systems support all phases of the decision-making process from problem formulation phase, through design, selection, to implementation. These systems support, not replace decision-makers. [2]

DSS are complex computer programs that can predict the behavior of the real system in some future circumstances, based on input data from a database and using various mathematical models.

DSS enables managers to test the system behavior in various conditions and environmental changes, as well as to test the reaction of the environment to the various changes in the system. DSS allows to quickly look at the effects of different strategic decisions.

The main objectives of DSS are:

- Helps executives in the decision-making process,
- Supports but does not replace decision-making process of management, and
- Improves the efficiency of logistics decisions.

Decision support systems are based on different mathematical, simulation and analytical models, which are designed to assist in the decision-making process. These systems use information from the database and outputs of Automatic Data Processing (ADP's). DSS processes data, using different models, and the output is analytical form of data . DSS actually presents an analysis and on the basis of the analysis recommends decision. It is necessary to point out that the DSS does not make a decision, but has a role to help the manager to make the decision faster and better than would otherwise be possible.

The basic functions of DSS are:

- Collecting all the necessary input data - DSS uses data from the information system's database.
- Data processing and analysis - Data processing and analysis are performed using mathematical models, which describe the real system and the relationships inside it.
- The application of different models of decision-making -DSS includes various models of decision making, which provide alternative solutions for different management strategies for real system.
- Presentation of different solutions - The resulting alternative solutions are presented in a suitable form so that users can quickly and easily see their advantages and disadvantages.
- In practice, there are two types of decision support systems:
- Closed systems, and
- Open systems.

Closed DSS define a complex mathematical model that describes the real system. The model has integrated all the input parameters and operational constraints. Based on the model of the system and different models of decision-making, a set of optional solutions is obtained for the problem. From a set of proposed solutions, user can choose what solution for that assignment will be the most effective in practice.

Open systems are interactive systems which enable communication between the user (manager, dispatcher) and the computer. DSS, based on the model of decision making, suggests various alternative solutions, and the user is in a situation that he can enter individual corrections, thereby changing solutions. This is an iterative process that ensures the integration of decision making and human knowledge, which is not always possible to formulate and present mathematically.

DSS is composed of different subsystems. In theory, there are no strict rules that each subsystem must have, but practical experience and function of the system point to a basic set of subsystems. The main subsystems are:

- Data management subsystem,
- Subsystem for management models,
- Knowledge management subsystem,
- Subsystem for communication with the user,
- User.

Base of the need to use DSS is a user's dilemma, so it is considered to be the initiator of the decission making process [4]. To resolve the dilemma, the user defines the problem where DSS helps through recording, monitoring and data collection from external and internal data sources, that helps to determine the origin and nature of the problem. Upon completion of formulation of the problems, DSS performs data processing using the database and / or the knowledge base. On completion of the processing of problems, DSS offers the user a number of available alternatives. Using the indicators of the degree of satisfaction of the posed problem of each alternative, the user selects the best. By analyzing and questioning the consequences of his choice under the influence of environment that can not be controlled (eg, social and economic factors), user is left with information / knowledge for future use, as a final outcome of the decision making process.

III. FUZZY SCREENING METHOD

Fuzzy Screening is a decision support method which is used in various environments, where it is necessary to allocate smaller subclasses from one class, based on certain criteria. In order to sort out a subclass, a prior knowledge is needed, meaning that this screening method is based on previous information. The experts have this knowledge, who use it to single out a subclass (alternative), on the basis of certain criteria guiding the problem.

Using this method, each alternative is evaluated by experts to meet the criterion of his multicriterial functions. Each criterion can have a different level of importance. Reviews of individual experts are then merged, giving a total score of functionality.

Procedure of Fuzzy Screening method begins with an assessment of the importance of criterion by experts (how much is every criterion important for each expert). Thereafter, each expert evaluates each alternative separately, for each criterion. To calculate the mean score for each alternative, it is necessary to deny scores of criterion importance (if we have a scale of 1 to 7, negated score 1 will be 7, 2 will be 6, etc.). The formula for calculating the mean score of each alternative separately is as follows:

$$U=MIN\{\neg I(j) \vee P(j)\} \qquad (1)$$

Where I (j) is the score of criteria importance of appropriate criteria by an expert, and P (j) is the assessment of alternatives for the appropriate criterion by the same expert.

After the obtained average marks for all alternatives by all the experts, we can form a table with the names of alternatives as well as medium scores for these alternatives sorted from higher to lower. Scores sorted in this way will be represented as B (j).

Total score for each alternative is calculated with the following formula:

$$b(k)=Int[1+(k*(q-1)/r)] \qquad (2)$$

$$k=1..r$$

Where:

q – is number of scores on a scale;

r – is number of experts;

Int – meaning it is a integer number, rounded to the higher number;

k – is a value (threshold) of scores in the sequence of 1 to r.

As a result we obtain the value of Q, which represent the threshold from Q (0) to Q (r), and must be as much as experts involved in the evaluation of alternatives.

Q (0) = S1, which means that it equates with the lowest mark on our scale, while Q (r) = Sq represents the highest mark on the scale, and the other values for Q are determined through a formula b(k).

The total score for each alternative is calculated with the formula:

$$X(i)=MAX(B(j) \wedge Q(j)) \qquad (3)$$

where X (i) represents the total score for the alternative (i), and is calculated by looking at the maximum score from a series of minimum scores between B (j) and Q (j).

IV. FUZZY SOFTWARE AND EXAMPLE

Through an example, we can easily explain what exactly is Fuzzy Screening. As an example we will take the selection of candidates for a job - we have many candidates X, who submitted a biography with only the necessary data for the contest. Based on these biographies, few of candidates X, which will form a subset A, will be invited for an interview. During these discussions we will learn much more information, which will be the basis for selecting the winners from a subset of A.

We assume that Microsoft has announced an open competition for the job of developer.

We also assume that a large number of candidates have applied, of whom it was expected to submit a biography and describe their knowledge of programming skills, foreign languages, as well as readiness for teamwork.

Let three experts (leaders from the three different sectors, support, design and maintenance) decide which criterion has greater importance on a scale of 1 to 7 (one of the least importance, while seven of the highest importance rating). Scores are shown in Table 1.

TABLE 1. SCALE OF SCORES

Value of score	Score
OutStanding OU	7
VeryHigh VH	6
High H	5
Medium M	4
Low L	3
VeryLow VL	2
None N	1

Scored criterion can be presented in the following table (Table 2.):

TABLE 2. SCORES OF CRTIERION

Experts	Programming	Languages	Team work
Support expert	6	4	3
Design expert	4	5	6
Maintenance expert	2	7	4

The majority of candidates who do not meet the required skills are eliminated from further competition. Suppose a small subset found only two candidates who have proven to be best for the job. Now every expert will give special scores, for each criterion, for the two candidates. This will be shown in the next three tables (Table 3, Table 4, Table 5).

Support expert first evaluates each candidate separately for each criterion. After the entered score, the mean score of each candidate is calculated.

TABLE 3. SCORES OF ALTERNATIVES BY SUPPORT EXPERT

Support expert	Programming	Languages	Team work	Mean score
Candidate1	4	6	7	4
Candidate2	5	3	5	4

Average grade is calculated by looking at the minimum value of the larger scores between expert assessment of candidates for certain criteria and the negation of the importance of criterion for this expert. The formula for calculating the mean score of Candidate 1 is as follows:

$$U=MIN(\neg 6 \vee 4, \neg 4 \vee 6, \neg 3 \vee 7)$$

$$U=MIN(2 \vee 4, 4 \vee 6, 5 \vee 7)$$

$$U=MIN(4,6,7)$$

$$U=4$$

The mean score for candidate 1 is 4. All other scores are calculated the same way:

TABLE 4. SCORES OF ALTERNATIVES BY DESIGN EXPERT

Design expert	Programming	Languages	Team work	Mean score
Candidate1	5	2	4	3
Candidate2	1	7	4	4

TABLE 5. SCORES OF ALTERNATIVES BY MAINTENANCE EXPERT

Maintena. expert	Programming	Languages	Team work	Mean score
Candidate1	1	7	6	6
Candidate2	5	6	4	4

After all obtained mean scores for both candidates, we form a new table (Table 6.), which contains information about the candidates and their mean scores sorted from higher to lower (denote as Bi).

TABLE 6. SORTED MEAN SCORES

Candidates	B1	B2	B3
Candidate 1	6	4	3
Candidate 2	4	4	4

The following formula is used to calculate the total score for each alternative:

$$b(k)=Int[1+(k*(q-1)/r)] \qquad (4)$$

where:
q – represents number of scores on a scale (in this case it is 7);

r – is number of experts (here it is 3);

Int - meaning it is an integer number, rounded to the higher number;

k - is a value (threshold) of scores in the sequence of 1 to r.

After we calculate the formula, the following is obtained:

$$b(k)=\mathrm{Int}[1+2k] \qquad (5)$$

When the k is inserted, following scores are:

Q(1)=3 , on our scale this is the value Low,

Q(2)=5, on our scale this is the value High,

Q(3)=7, on our scale this is the value Outstanding.

The number of scores Q(x) must be as same as the number of experts who gave the scores to the alternatives.

And finally the next formula gives the solution to the problem (final score for every alternative, in this case for both candidates):

$$X(1)=MAX(Q(1)\wedge B1,Q(2)\wedge B2,Q(3)\wedge B3).$$

With the inserted values this will be:

$$X(1)=MAX(3\wedge 6,5\wedge 4,7\wedge 3)$$

$$X(1)=MAX(3,4,3)$$

$$X(1)=4$$

The final score for candidate 1 is 4 (Medium on our scale). Score for candidate 2 is being calculated the same way:

$$X(2)=MAX(3\wedge 4,5\wedge 4,7\wedge 4)$$

$$X(2)=MAX(4,4,4)$$

$$X(2)=4$$

The final score for candidate 2 is 4. These scores are shown in table 7:

TABLE 7. FINAL SCORES

Candidates	Final score
Candidate 1	4
Candidate 2	4

We come to the conclusion that both are equally good candidates for the job, although they have different knowledge or evaluation of criteria by which they were tested.

Software for Fuzzy Screening method is written in C #, easy to use, with only a few user forms. When starting the program, a form is opened which will guide through the method. Figure 4 shows the form Alternatives, where we have access to a list of alternatives, and the user himself can add new alternatives.

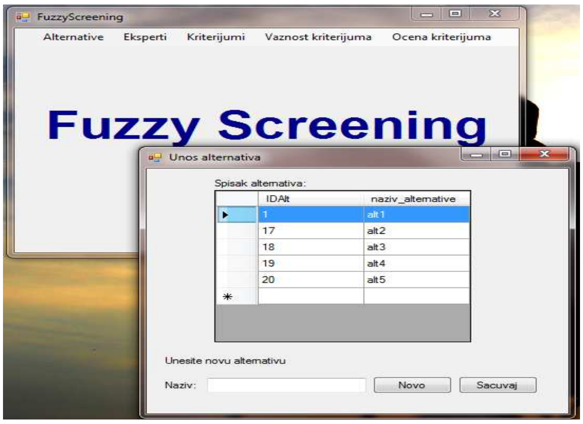

Figure 4. Alternatives form

The forms Expert and Criterion works the same way, as seen on figure 5. Figure 6 shows the form Criterion importance, where experts give scores for criterion importance. The last form, Review of criteria, is formed the same way, where experts enter scores for the alternatives. After entering all the scores, by pressing the "Calculate" button, you get the final evaluation of alternatives, which is the goal of Fuzzy screening method (figure 7).

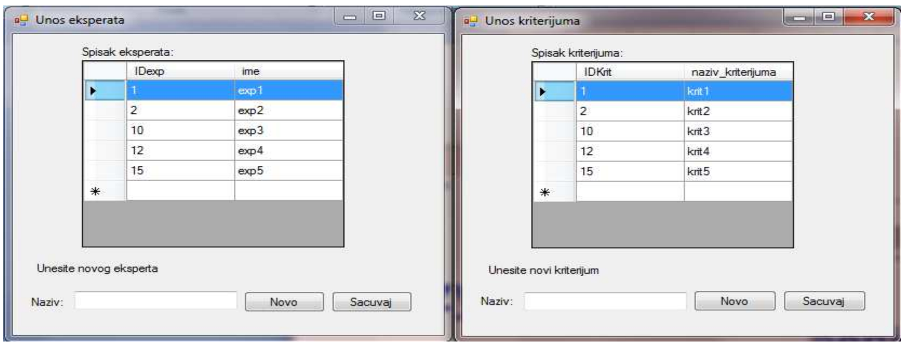

Figure 5. Expert and Criterion forms

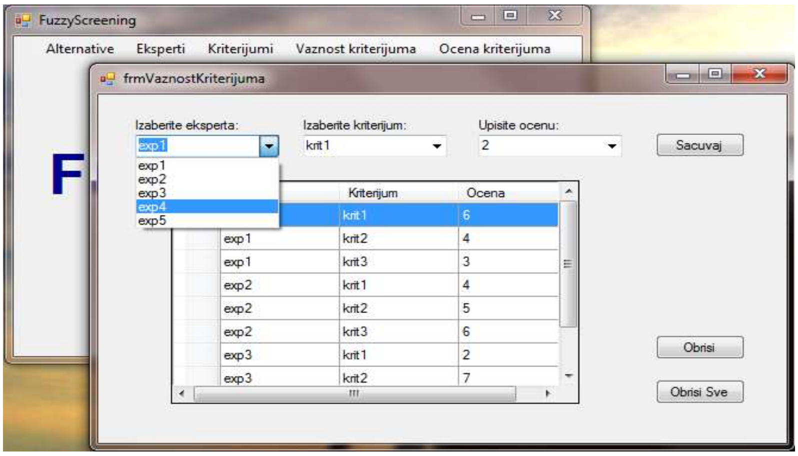

Figure 6. Criterion importance form

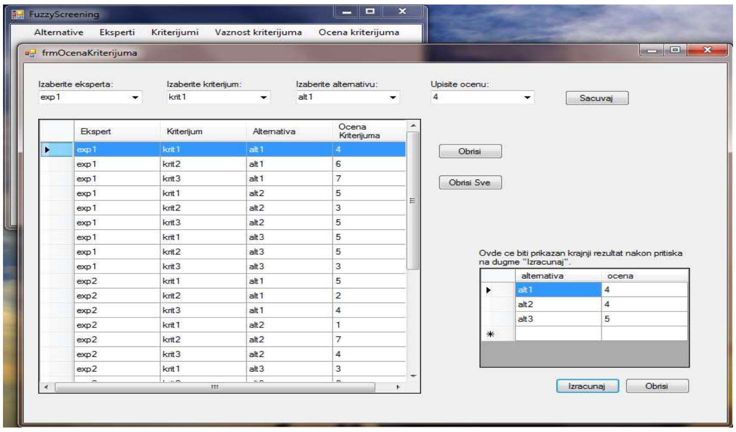

Figure 7. Review of criteria form

V. CONCLUSION

Fuzzy Screening is a very useful and simple method to use when you need to choose a small group, from a large group of alternatives. In a very quick way it can be seen which alternatives do not suit us, or are less appropriate than others, and eliminate them from further examination, on the principle of minimal information and a small number of selected criteria. Furthermore, this smaller subgroup of examinees is questioned, and leads to the best alternative according to the set criteria.

In our example, as we have seen, although the final assessment for the two alternatives are equal, they have different scores of the criteria we have examined, and based on Fuzzy screening method and priority of the criteria (importance), the final estimates for the alternatives were taken.

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APPLICATION OF COMMERCIAL AVAILABLE HARDWARE IN THE MAKING OF FLIGHT TRAINER

S. Vlačić*, A. Knežević*, M. Milutinović**
*Military Academy, Belgrade, Republic of Serbia
**AF&AD, Serbian Armed Forces
slavisavlacic@yahoo.com; aleksandarknezevic75@gmail.com; milosmilutinovic@gmail.com

Abstract – Application of trainers and flight simulators are inevitable part of the pilot training process, either military or civil. Flight training devices and flight simulators, which are made by specialized companies and aircraft producers, are overpriced unfairly in many cases. That leads to alternative solutions. In the domain of flight, training devices it is possible to make simple one it on its own, and on some level, to implement commercial hardware components. Using give us the possibility to create flight training device of satisfying characteristics, with moderate investments. This paperwork describes one example of such flight-training device and its application in the first phase of military pilot training in the Military Academy.

I. INTRODUCTION

Flight training represents the foundation of successful education of military pilots. Its division is based on medium and phase of realization. Regarding to medium, it can be realized on ground or in the air. Military flight training consists of four phases: primary, basic, advanced and combat flight training. The first step for each of these phases is ground (theoretical) preparation, which is integral part of the flight training. The division by the phases was not changed for almost half a century and it would not be changed in the near future. Main teaching methods in the air were not changed, too. However, the main changes emerged because of new training aircrafts, regardless of airplane or helicopter type. Producer usually delivers those aircrafts to the end user with wide spectrum of additional training devices. All those training devices are connected closely with technical advances in the field of hardware and software. In the very beginning, training devices were developed and produced exclusively by original manufacturer. This was also meaning the bigger price, caused by the industrial monopoly and by application of rigid industrial and military standards.

Thanks to remarkable development of the hardware and software, these items become affordable from the standpoint of performance and standpoint of prices. This fact also gave the possibility to develop and create some form of flight training device by using cheap commercial available hardware. Researchers from the Military Academy create flight trainer of satisfying characteristics, with moderate investments.

II. FLIGHT TRAINERS

A major milestone in the development of flight trainers and simulators[1] was achieved by digital computers, which were installed in the flight trainers and simulators during the sixties. Further progress of computer technology and electronics in general, was provided especially by processing power, advanced software, visualization devices, the emergence of liquid crystal displays (LCD), high-resolution color projector, etc. At the same time, these technologies have become financial available, marking a revolution in the field of flight simulation.

Flight trainers are used for flight simulation and according to international standards; they are only the part of so-called Synthetic Training Device (STD). Flight simulation is an artificial creation of aircraft flight and various aspects of the flight environment. Flight simulation is used for a variety of reasons, but the main reason is flight training [1].

Present day flight simulation systems exist in many different forms. This spectrum encompasses a wide variety of fidelity regarding both physical cockpit characteristics and quality of software models, as well as various implementations of sensory cues such as sound, motion, and visual

[1] The main difference between the trainer and simulator is that the trainer can not simulate all the plane systems on the board. Flight simulator can do it.

systems. Their implementation depends on the end user needs and his financial capabilities to procure and operate devices for flight and aviation systems simulation.

In this way, during the time, the categorization of training devices and flight simulators was made. Nowadays it is possible to note a variety of different categories of training devices and flight simulators. The Civil Aviation Directorate (CAD) of the Republic of Serbia accepts EASA regulation and European Aviation Authorities (European Aviation Safety Agency - EASA, JAA former). CAD recognizes flight trainers and simulator as part of Synthetic Training Devices (STD).

Synthetic Training Devices (STD) are consisted of [2]:

Flight and Navigation Procedures Trainer (FNTP) is used for generic flight training. A generic, but comprehensive flight model is required, and many systems and environmental effects must be provided. Includes all equipment and computer systems needed to simulate the aircraft in flight, with all systems have to function as the real aircraft. FNTP device is used mostly for IFR/VFR training. The basic concept is a non-motion trainer with a cockpit enclosure generally representative of the model of single engine or light twin.

Flight Training Device (FTD) is used for either generic or aircraft specific flight training. Comprehensive flight, systems, and environmental models are required. FTD is a replica of the cabin space of a certain type of aircraft, its instruments, all the switches and control systems, including all equipment and computer systems needed to simulate the aircraft on the ground and in the air. Due to lack of the motion system, it is categorized as a trainer.

Full Flight Simulator (FFS) is a replica of the cockpit of a certain type of aircraft in real size. It is used for aircraft-specific flight training under rules of the appropriate National Civil Aviation Regulatory Authority. Under these rules, relevant aircraft systems must be simulated fully, and a comprehensive aerodynamic model is required. All FFS require outside-world (OTW) visual systems and a motion platform. A motion system is required with at least three degrees of freedom.

Full Mission Simulator (FMS) is a category of Full Flight Simulator used by military users. In addition to high fidelity simulation of the flight, it is able to simulate the tasks and missions that are performed by the real combat aircraft.

Modern trainers are categorized in three levels. Simulators are divided from A to D level. This categorization is done practically according to the level of fidelity and completeness of the simulation, the dimensions of the visual field, the quality of screening, quality of motion system and sound, etc.

All those STD are, without exceptions, extremely expensive and they are only partially available for our AF&AD. For example, the FFS flight hour for the MiG-29 or Supergaleb G-4 costs over 300 euro.

However, beside the officially categorized device which purpose is to simulate the flight, there are a number of other devices and equipment, which are intended for better quality of the flight training. Their aim is to adapt future pilots to their working environment, plane cockpit and instruments, to train them in operation of switches and equipment and allow practicing instrument procedures during normal and emergency procedures. There are different names and designations, which is in many cases related to the manufacturer of this equipment. In this way, we can find devices such as Part Task Trainers (PTT) or Cockpit Procedures Trainer (CPT). They are significantly cheaper than the simulator and trainer and they are widely used on the less sophisticated aircrafts.

It is common practice that before the training on FTD or FFS, students perform part of their training in commercially available PC platforms, which are making flight training considerably cheaper. Understanding the basics of flying a specific aircraft or flying in general, and understanding devices and aircraft systems, is done through interactive software that largely replaces the classical teaching tools in ground training (chalk, blackboard, projector, scripts, complex technical schemes, plane models, real models, etc.). On the PC platform can be installed even the simplest software for the flight simulating. Through this approach, students often have the option of having interactive software on their computers. In this way, they are not limited to the classroom. The instructor has the possibility of easier and better insight into the student's level of progress thus increasing the quality and safety of flight training. This approach, i.e. the type of training is called the Interactive Computer-Based Training System - ICBT) [3].

To fill a gap between the FFS and ICBT, the project team from the Military Academy has decided to create flight trainer using commercial available hardware components.

III. Using Commercial Hardware in Military Flight Trainer

There are many different approaches in the field of choosing components when you intend to create a technical system, which will be used by military. For a long time of period military strictly followed procedures that were established by military standards and quality requirements.

However, high prices of development and long period of component and system acquisition in operational use impose different approach in application of standards.

Today, many militaries are buying and using items, which are not developed and produced according to military standards. Such items are known as COTS (Commercial Off-The-Shelf).

It is also item that is commercially available, leased, licensed, or sold to the general public and which requires no special modification or maintenance over its life cycle [4].

According to the U.S. Federal Acquisition Regulation COTS term, defining a non-developmental item of supply that is both commercial and sold in substantial quantities in the commercial marketplace, and that can be procured or utilized under government contract in the same precise form as available to the general public. For example, technology related items such as computer software, hardware systems or free software with commercial support and construction materials qualify, but bulk cargo, such as agricultural or petroleum products , do not.

The use of COTS has been mandated across many government and business programs; as such products may offer significant savings in procurement, development, and maintenance.

Motivations for using COTS components include hopes for reduction of overall system-development and costs (as components can be bought or licensed instead of being developed from scratch) and reduced long-term maintenance costs. In the 1990s, many regarded COTS as extremely effective in reducing cost and time in software development. COTS software came with many not-so-obvious tradeoffs - initial cost and development time can be reduced, but often with an increase in software component-integration work and a dependency on the vendor, security issues and incompatibilities from future changes.

Using this way of thinking, Military Academy teachers have decided to create flight trainer from COTS software and COTS hardware components. In the first phase of creating the flight trainer, the Flight Simulator 2004 and the Flight Simulator X were chosen as a software gap solution.

A. Flight Simulator X

Microsoft Flight Simulator X, also known as FSX, is a 2006 flight simulation computer game originally developed and published by Microsoft for Microsoft Windows. It is the next in the sequence after Microsoft Flight Simulator 2004. It is the tenth and last installment of Microsoft Flight Simulator series. It includes a graphics engine upgrade.

Flight Simulator X was released in three editions: Standard, Deluxe, and later Gold. The Deluxe Edition incorporates additional features, including an on-disc software development kit (SDK), three airplanes with the Garmin G1000 Flightdeck, and the ability for the player to act as Air Traffic Control (ATC) for other online users with a radar screen.

The Deluxe Edition features 24 aircraft compared to 18 in the Standard Edition; 45 high-detail airports compared to 40; 38 high-detail cities compared to 28; and 51 structured missions compared to more than 30. Microsoft Flight Simulator X: Gold Edition combines the Deluxe Edition and the Acceleration expansion pack into one [5].

If we speak about worthiness of software like Flight Simulator X, we must consider the kind of simulators and simulations that exist on the market. Simulation can consist of virtual modeling on a computer workstation, part task devices with actual system hardware and software, or full-mission man-in-the-loop simulators with visual systems and motion. All of them have their place in the process, and play a role in shortening development time and cost.

According to above, this Microsoft flight simulator software can be classified as virtual modeling on a computer workstation.

This kind of software can be used on typically PC configuration, without special demanding. That means OS Windows XP SP2 or higher, processor of min 1.0 GHz, hard drive of 15GB free space, DirectX9 hardware compatibility and video card with 32 MB of RAM.

To bring the new level of fidelity and completeness of the simulation, the dimensions of the visual field, the quality of screening, great improvements has to be made. The goal was to make clear difference between PC simulation and flight trainer. This was possible to done only with use of modern COTS hardware.

B. Flight trainer hardware

One of the primary goals of creating the flight trainer was widening the dimension of visual field. There are several ways to achieve that, depending on what kind of trainer you want to make. Usually, simulation based trainers (SBT) are used for:

- Self paced normal procedure learning;
- Self paced emergency procedure learning;
- Cockpit/HOTAS familiarization;
- Variety of mission (SA / Networked) [6].

Typical representative of that kind of STD is given in Figure 1.

Figure 1. Typical Simulation based trainer

As one can see from Figure 1, there is very limited field of view (FoV) involving only cockpit and part of canopy glass shield.

On the other hand, PTT or CPT amongst many other things is required to have:

- FoV 180° x 60°;
- IOS same as FMS (instructor "friendly") ;
- Cockpit "representative" of our planes;
- Visual Data Base (distance) 0.5 m [6].

Primarily, flight trainer that Military Academy development team has made is simulation-based trainer (SBT) concerning the fact that the cockpit of any simulated type of airplane is not included in configuration.[2] As said earlier, since the primary goal was to create wider field of view, development team has introduced new technique. With use of three high definition (HD) projectors on three projection screens and one HD monitor more realistic situational awareness was achieved.

Three HD projectors with overall resolution of 3480 x 1280 pixels enables trainee to experience the required FoV 180° x 60° (Figure 2) that can be rotated spherically with head movements tracking.[3] Furthermore, visual database of 0,5 m is provided with use of one HD monitor that displays cockpit instrumentation layout of desired airplane (Figure 2).

Figure 2. Military academy development team SBT

In order to accomplish all given tasks, COTS hardware used in SBT trainer given in Figure 2 is of the high-end or close to high-end components. Hardware components survey is given in Table 1.

TABLE I. FLIGHT TRAINER HARDWARE AND SOFTWARE SURVEY[4]

Nr.	Computer Profile Summary	
	Component name	***Component profile***
1	**Operating System**	Windows 8.1 Professional N (x64) (build 9600)
2	**System Model**	ASUS All Series Enclosure Type: Desktop
3	**Processor**	4,00 GHz Intel Core i7-4790K Multi-core (4 total) Hyper-threaded (8 total)
4	**Main Circuit Board**	Asustek COMPUTER INC. MAXIMUS VII RANGER Rev 1.Xx
5	**Memory Modules**	8136 Megabytes Usable Installed Memory DDR3
6	**Drives**	WDC WD10EZEX-00BN5A0 [Hard drive] (1000,20 GB) -- drive 0, s/n WD-
		ATAPI iHAS122 E [Optical drive]
7	**Video adapter**	NVIDIA GeForce GTX 760 [Display adapter] (2x)[5]
8	**Displays**	BenQ GL2450H [Monitor] (24,0"vis, s/n 46E00194019, jun 2014)
		3 x Hitachi CP-DX250 projector XGA 1024 x 768 resolution 2,500 ANSI lumens light output 2500:1 contrast ratio

[2] This is planned as next step in flight trainer development.

[3] Provided with the use of Track IR head movement recognition system.

[4] Peripherals like flight stick, yoke, throttle quadrant and rudders are not shown.

[5] Physically one graphic card, but SLI mode.

Nr.	Computer Profile Summary	
	Component name	*Component profile*
9	**Peripherals**	Matrox TripleHead2Go

To make trainer more realistic the real ejection seat was installed as a seating place for the trainee and a pilot helmet is also provided. The flight yoke or stick, combined with rudder command and throttle quadrant also make trainer more realistic.

Concerning hardware and software survey given in Table 1, Windows generates 7, 8 Windows experience index for key components as representation of respectable configuration.

One of the enduring problems with any flight trainer is the restricted FoV imposed by the computer display screen. This restriction severely limits peripheral vision, which in turn detracts from perceived realism. Military simulators use multiple screens to provide a wider FoV. In this case, team use the Matrox TripleHead2Go peripheral to expand scenery over three canvases (one canvas dimension is 2 x 2 m) via three HD projectors, but that is not very practical for PC-based simulation.

The Matrox TripleHead2Go expands Flight Simulator X across three canvas (Figure 2), providing a panoramic view that lets you see more of your virtual cockpit and improves your flight visibility at the same time. This extended view provides a more realistic flight experience by fully engaging your peripheral vision on the side displays.

FSX simulator is mainly used to demonstrate cockpit views and basic systems characteristics in the aircrafts used in real flight training (UTVA-75, Supergaleb G-4, Gazelle). It works with obvious success.

However, it is important to emphasize that during the flight-training phase in military jets some full-scale flight simulators are used [7].

The first two generation of cadet pilots who started their flight training after practicing this trainer show better performance in basic stages of flight syllabus.

It is also important that this trainer cost eight times less then industrial proposal prices for the simple cockpit trainer.

The next phase in the use of this flight trainer is creating the add/on software for the new training aircraft Lasta. There is also possibility to acquire the mock-up cockpit of Lasta aircraft. This is done by taking into consideration needs of the Serbian Air Force Command. In such mock-up cockpit, it is possible to introduce switches, buttons and levers almost identical to real plane that can be also found on market, because the Lasta plane is produced based on civilian FAR 23 standards. It means that many components, including switches and buttons are commercially available.

The importance of training is clearly showed by using different synthetic training device. Acquisition and equipping with modern equipment and adequate devices for pilot training is a necessity and one of the priorities of the aviation branch modernization. In its analysis and official documents the Air Force Command stated that trainer and simulator use in pilot training could significantly reduce training costs and increase efficiency of training.

IV. CONCLUSION

Main changes in the flight training process were caused with new airplanes equipped with modern hardware and software in different domains. It is most obvious in the aircraft cockpit layout. The main goal of their incorporation was higher level of flight safety, better efficiency of training and, as a most important greater combat efficiency of the airplane as a platform. Higher demands placed in front of trainees were somewhat compensated with wide use of flight trainers and flight simulators. Their use in modern training is inevitable. For many years, training devices were developed and produced exclusively by original manufacturer. This led to the high price, caused by the industrial monopoly and by application of rigid industrial and military standards. Remarkable development of the hardware and software did those items more affordable than ever if we are considering price and performances. This fact opened the door to the less specialized personnel to create and develop some training device. The great change was also done by wide recognizing and involving COTS components in the process of creating systems for the military use.

Those facts enabled the less experienced staff to create its own trainer only by use COTS components including both software and hardware. Military Academy stuff acquired Flight Simulator X. To simulate domestic airplanes (UTVA-75, Supergaleb G-4, Gazelle) which are not involved in FSX package the specific add ons have been created as a long-term process. This software package was installed on the high-end hardware configuration what was commercially available at the moment. The main point was use of the Matrox TripleHead2Go peripheral to expand scenery over three canvases via three HD projectors.

The Matrox TripleHead2Go expands Flight Simulator X view across three canvases (full displayed vision is 6 x 2 m) providing a panoramic view that lets you see more of your virtual cockpit and improves your flight visibility at the same time. This extended view provides a more realistic flight experience by fully engaging your peripheral vision on the side displays.

To make trainer more realistic, the real ejection seat was installed as a seating place for the trainee and a pilot helmet is also provided. The flight yoke or stick, combined with rudder command and throttle quadrant also make trainer more realistic.

This kind of flight trainer was created by the price that is eight-time less than industrial proposal price. It represents good platform for further development involving wooden cockpit mock-up and switches, buttons and levers almost identical to real plane. All of that can be made at significantly lower price only by using commercially available hardware and other components.

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INFORMATION COMMUNICATION INFRASTRUCTURE IN TEACHING PROCES

DEVELOPMENT AND EVALUATION OF VIRTUAL LABORATORY FOR ENGINEERING EDUCATION

K. Bogatinova, S. Koceski, N. Koceska
Goce Delchev University, Stip, Republic of Macedonia
{kristina.bogatinova, saso.koceski, natasa.koceska}@ugd.edu.mk

Abstract – Practical component is often considered as one of the most important characteristics of the engineering education. In this context engineering education laboratories play very important role, by helping the students to test theoretically acquired knowledge, enabling them collaborative environment, trial and error learning approach and offline analysis of the experimental results. However, permanent availability of the laboratory and the equipment is one of the main problems in the process of learning. Sometimes, they are even completely missing. The rapid development of information and communication technologies in the last decades has made a huge impact on the education system with a special emphasis on the engineering subjects. The advances of web technologies on the other hand have also significantly improved online and collaborative learning, and students' learning experience in general. This paper presents a developed virtual online laboratory that aims at helping high school students in learning physics. It consists of several virtual benches developed as separate fully interactive web modules. The benches ware developed to follow the high school curricula of the physics courses in Macedonia. The design and development technologies and system architecture are also presented. The laboratory has been evaluated from both students and teachers. The results of the evaluation are also presented in the paper and conclusions are drawn.

I. INTRODUCTION

The project described in this paper explores how to create a virtual lab environment that would be interesting, interactive, easy to understand and accessible to students and teachers in order to facilitate the study of physical phenomena in certain areas.

Macedonian education reforms were applied on several occasions, but the conventional teaching, books, blackboards and notebooks generally retained its place at most classes. In addition, there are a very small proportion of schools with modern and highly equipped laboratories; at most, schools the laboratory equipment is outdated, and at some, there are no labs at all. To enable a modern laboratory, a large budget for the schools is needed. In R. Macedonia a very small portion of schools operate this budget and those are mostly private schools, whereas the majority of the education is provided by public schools with very small budget. To solve these problems, an alternative and better approach is taken, that is design and implementation of virtual laboratories.

Also in the framework of this project, the students are provided with self-evaluation questionnaire and exercises.

Assistance for the laboratory is provided in text format as well as a theoretical support for the topic that the laboratory exercise presents.

II. MAIN OBJECTIVE AND THEORETICAL BACKGROUND

A. *Discovery learning and Constructivism*

Discovery learning is a very common way of learning new things. By means of learning through research, people acquire knowledge without being aware of it. It is an inquiry-based, constructivist learning theory that takes place in problem solving situations where the learner draws on his or her own experience and existing knowledge to discover facts and relationships and new truths to be learned. Learning through research and discovery is almost without any effort for the student.

Discovery learning takes place in a problem solving situations where students interact with the world by exploring and manipulating objects, asking questions, or performing experiments. As a result, students are more likely to remember concepts and knowledge discovered on their own. The models that are based upon discovery learning model include guided discovery, problem-based learning, simulation-based learning, case-based learning, and incidental learning among others.

In our case, emphasis is placed on simulation-based learning.

The development philosophy of learning argues that the most important role of the teacher is to provide students an environment in which they can engage in spontaneous exploration and exploitation. This environment should provide opportunities that will motivate and activate the students. All students have different development processes and should gain understanding and knowledge through their own experiences.

The act of learning is an active process in which errors and problems emerge which needs to be resolved. Both students and adults are involved in something called constructivist-learning method, if the originality of what they are learning is close enough to their real world experience.

Constructivism includes active participation and involvement of students in the practical experience of activities at some stage in order to make the learning experience more real. Constructivism should be used in the design of simulations for learning. For interactions in simulations, it should:

- help students to understand the relationship between the objects, issues, causes and effects.
- make and keep students engaged and motivated.
- improve students understanding of what is simulated [1].

B. Observations and theoretical approach

Conducted observations have shown that simulations can be very interesting educational tools. However, this requires the interaction of students with the simulation to be directed and governed by the interests and questions of the students. The simulations can be effective for teaching all ages of students from primary and secondary school, to university students [2].

In addition, it is found that the simulations help students overcome cognitive limitations that come from personal, often erroneous, systems of belief to natural phenomena derived from their own life experience [3].

Simulations reduce the cognitive load on students and makes learning more efficient by allowing students to avoid the language barrier of high technological terminology that is common in the classroom.

Students feel more comfortable and more accurate when describing the physics with the help of simulations, instead of using the terminology of the textbook [4].

This means that the design and implementation of simulations should be taken to ensure that the student fully understands the simulation; the student should not get the wrong impression or be misled when simulation is finished [5].

In general, students who have highly developed abstract reasoning benefit more from learning based on simulations. In addition, necessary steps should be taken to enable students who have less developed abstract reasoning to handle and understand these simulations [6].

III. Design of Virtual Laboratory

In the design of the simulation, two specific things are considered: Coherence Principle and Consistency. Coherent principle argues that simulations may not contain unnecessary material that distract the student thus disrupts the learning process. Consistency between simulations is also very important. Users who have more experience with simulations will learn to use simulations faster if they have a consistent design [1].

With the simulations, students are provided with animated visual model for easier understanding of the physical phenomenon. By doing interaction with the simulation, the student can participate in changing the parameters and analysis of results. Therefore, it is necessary to take into account the design of the simulations, because students give equal importance to the overall visual design [7].

Simulations are not supposed to reflect the reality in details, but to maintain the concept of the physical area that they simulate. For simulation to be sufficiently realistic, it is necessary to:

- implement connections and principles of the system which simulates;
- contain components with enough detail for the user to connect to the same components from the real world;
- allow the user to change parameters like in the real system;
- give the user the feeling that he or she directly controls the components of the simulation without any intermediate steps.

In short, the simulation should function as the actual system. Moreover, it should offer:

- a single and clear goal for the user;

- objects that can be interacted to successfully complete the simulation;
- environment that provide an appropriate context in the simulation;
- interactions, reactions, challenges, situations and effects that are equivalent to those of the real experiment;
- a feedback after the simulation or the task is completed successfully;
- opportunities for returning simulation in initial state or to a previous state, such as back button or restart;
- allow users to have a sense that they control the application.

IV. Implementation of Virtual Laboratory

A. *General imlementation issues. Used Tools*

There are various types of applications with the same purpose, but they are generally made in older technologies or technologies that are not very used (in extinction), some are made as multimedia applications that require a portable disk (CD, DVD or USB flash drive) or installation. Online simulations offer some foreign websites that are not on the preferred language, nor designed in order to attract the attention of the students and help them.

In the creation and implementation of the laboratory are used newer web technologies such as HTML5, CSS3 and JavaScrip programming language. These technologies are selected for their abilities and the direction in which web technology moves. These technologies are available and free to use. According to the browsers statistic [8] most used browsers support all the definition for HTML5 and CSS3 and because of their great implementation in web browsers, the simulations made in these technologies allow 99% availability and accessibility, except for some older browsers that do not support these technologies.

An exception is made in graphic design of the simulations, the working area is on top, and control panel is below the working area, and it can be fully visible on the small size screens like laptop (15 inch) and multimedia devices - tablets with screen sizes of 10 inches. The application is not designed for mobile devices, because the screen is too small. However this is not a disadvantage because the purpose of this simulations is for education.

Virtual laboratory that is implemented consists of multiple simulations from different areas of physics, in order to provide conditions for performing experiments by the students of secondary education (Figure 1).

It is a web site with a structure which is represented in Figure 2. The simulations are presented with a picture and a text description of the topic they represent. The image and text are linked to the page where simulation can be directly started.

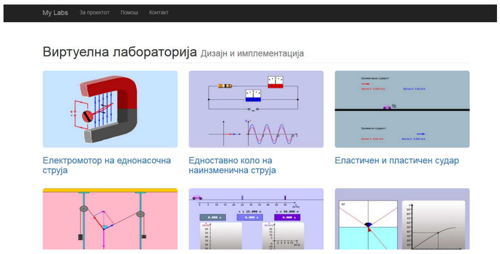

Figure 1. Site diagram for Virtual laboratory

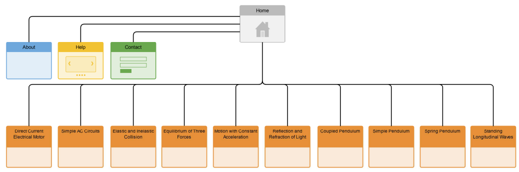

Figure 2. Site diagram for Virtual laboratory

In the following we will describe two simulations that are part of the laboratory. The simulations are designed following the recommendations given in the previous topic.

B. *Simulation: Elastic and inelastic collision. Law of preservation of momentum*

This simulation is designed to describe the physical law of preservation of momentum.

By clicking on the image or the title in the homepage of the website, loading of the web page begins with a scene that has work area and a control panel for the implementation of the exercise. The work area contains the animation and output values, and the control panel contains all control and input fields. As digital inputs are the fields for entering the mass and speed of vehicle 1 and vehicle 2. The controls for the selection of elastic and inelastic collision, as well as output details for speed, momentum and kinetic energy before and after the conflicts in the panel are represented by radio buttons. The possibility of "Slow motion" is a check box, to be distinguished from the other options because its functionality is independent of the description of physical phenomenal, it only slows the animation 10 times in order to analyze the type of collision slower.

Buttons for start and reset of the simulation are with simple mouse over animation and are with sufficient size to be readily visible.

Under the panel the buttons for "help for the simulation", "read more" and "check your knowledge" are placed.

On load of the site, default values are set for the parameters needed for simulation to function.

Extreme cases are limited to certain values of the masses and speeds of the vehicles, but they realistically reflect the desired outcome.

1) Use case diagram

Use Case diagram for this simulation is shown in the Figure 3. This diagram is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved.

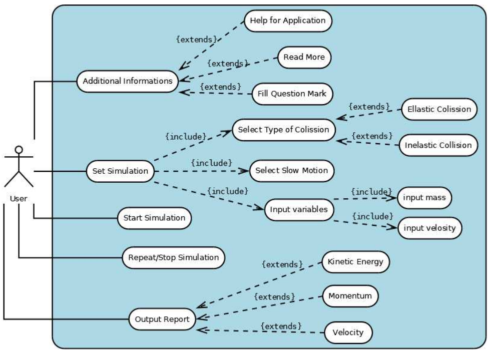

Figure 3. Use case diagram for simulation elastic and inelastic collision

The use case shows that the student can get additional information about the application, help about its usage or fill a question mark.

The student can also set the simulation by selecting the type of collision, movement speed and filling the input variables about the mass and the velocity of the objects. After the initial setting of the simulation the user can start it, repeat it or stop it.

Output reports serve to get information about the simulation.

2) Activity diagram

Activity diagram for this simulation is shown in the Figure 4.

This diagram is graphical representations of workflows of stepwise activities and actions.

First activity that the user should do is setting the initial conditions, choosing the type of collision, speed of the movement as well as setting the mass and velocity of both objects. After setting the Initial conditions the student can either start the simulation or reset the initial conditions. If the user chooses to start the simulation he has to chose the type of report output from the movements of both objects.

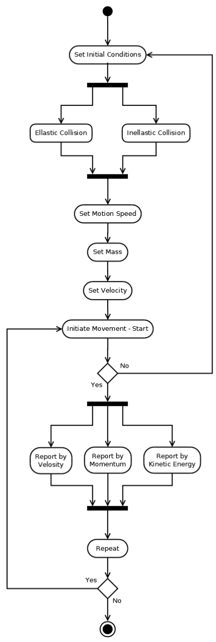

Figure 4. Activity diagram diagram for simulation elastic and inelastic collision

Output report can be divided in three ways, by velocity, by momentum or by kinetic energy. After the simulation ends and the output report is shown, the student can end the simulation, restart the simulation with the same initial conditions or start from the beginning of the simulation.

C. Simulation: Motion with Constant Acceleration

This simulation is designed to describe the physical law of “Motion with Constant Acceleration” (Figure 5). It shows vehicle moving with constant acceleration. The control panel contains text fields where students can vary the values of initial position, initial velocity and acceleration. By using the buttons at the top of the control panel, students can bring back the car to its initial position or stop and resume the simulation. If students choose the option "Slow motion", the movement will be ten times slower.

Three digital clocks, placed in the working area, indicate the time elapsed since the start. As soon as the vehicle has reached the blue respectively violet ramp with its front bumper, the corresponding clock will stop. Both ramps are adjustable by dragging the mouse with pressed mouse button.

On the working area are placed two diagrams that illustrate the motion of the vehicle: position x versus time t and velocity v versus time t.

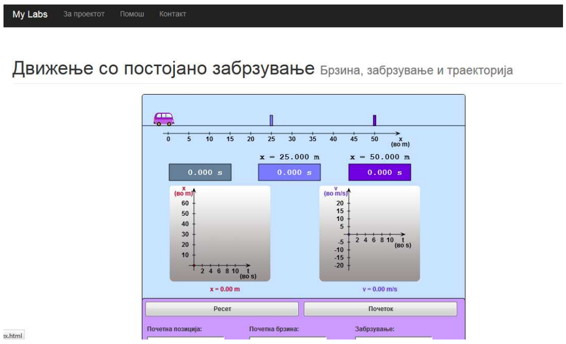

Figure 5. User interface for the motion with constant acceleration lab excersise

1) *Use case diagram*

Use Case diagram for this simulation is shown in the Figure 6. The student can set the simulation by selecting input variables. After the initial setting of the simulation the user can start it, repeat it, stop it or resume it.

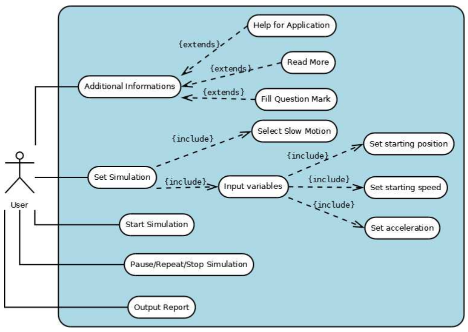

Figure 6. Use case diagram for Motion with Constant Acceleration

Output reports serve to get information about the simulation.

V. Evaluation and Results

The developed virtual laboratory was evaluated by 5 teachers and 100 students from two secondary school students (50 males and 50 females). Half of the students were thought the lessons through the classical way of teaching and the second half were using the developed virtual lab.

1) *Activity diagram*

Activity diagram for this simulation is shown in the Figure 6. First activity that the student should do is setting the initial conditions and adjusting the ramps positions.

After setting the Initial conditions, the student can either start the simulation or reset the initial conditions. After the simulation is finished, students can read the output values for the time.

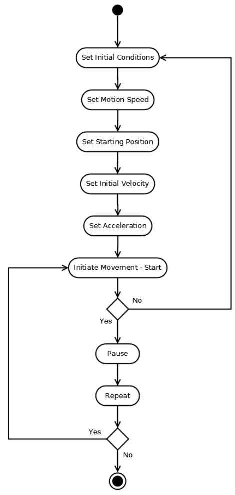

Figure 7. Activity diagram for Motion with Constant Acceleration

The students were chosen in a way that the average grades in both groups were almost the same. The evaluation methodology for students is composed of three phases: the first one is dedicated to system explanation; the second one is aimed at self-learning using theoretical materials which are accompanying each of the lab exercises and experimentation, as well as self-evaluation. The last phase is regarding the evaluation of the acquired knowledge using standard/classic test method and using a survey method. The teachers were asked to answer some questions regarding their personal opinion and observation for virtual laboratory usage. The results from the evaluation are presented in the following.

TABLE I. Results after testing

	Group type	*Average grade after evaluation (on the scale 1-5)*
1	Virtual lab group	4.86
2	Control group	4.11

TABLE II. PERSONAL OPINIONS ABOUT THE VIRTUAL LAB USFULNESS (AVERAGE ANSWERS ON THE SCALE 1-5)

	Group type	***Students***	***Teachers***
1	Do you consider the virtual lab useful?	4.80	5
2	Did you find the virtual lab user friendly?	4.98	5
3	Do you think it could be a possible substitution of the real lab (when the one is missing)?	5	5

VI. CONSLUSION

This paper presents a developed virtual online laboratory that aims at helping high school students in learning physics. It consists of several virtual benches developed as separate fully interactive web modules. The benches ware developed to follow the high school curricula of the physics courses in Macedonia. The design and development technologies and system architecture are also presented. The laboratory has been evaluated from both students and teachers perspective and the results obtained are promising.

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ENERGY APPROACH OF ACCURACY ESTIMATION OF P3 AND P4 STACEY BOUNDARIES

V. Kokalanov, A. Risteska, V. Gicev
Goce Delchev University, Stip, Republic of Macedonia
aleksandra.risteska@ugd.edu.mk

Abstract — the paraxial boundaries are artefacts used to simulate wave propagation out of the physical model to infinity. Their imperfection results with spurious reflection of the energy, which is travelling towards the boundaries. To quantify the error due to artificial reflection of the boundary, we calculate and monitor the energy emitted from the source and energy exiting the model. The reflection depends on the angle of incidence and the order of approximation. Using the law of conservation of energy, the accuracy of the Stacey's P3 and P4 boundaries is examined. The analyses are done with numerical models simulating full space and half space. Each model consists of inner part and periphery formed from the boundaries. The wave motion is generated from the source located in the inner part. Fifteen different locations for the source are used in order to obtain the dependence of the error on angle of incidence. The input energy is summation of the energy in time computed at a group of points symmetrically deployed with respect to the both axis and around the source location. In same manner, using the points of the artificial boundaries, we calculate the outgoing energy.

I. INTRODUCTION

The numerical analysis of the half space consists of reduction of the infinity to finite numerical model. The reduction is done with two types of boundaries. The top boundary is real, physical boundary on the interface between the air and the medium of the half space, and the other three are artificial boundaries. These boundaries must satisfy the physical laws and simulate the wave propagation to infinity. It means that they have to allow the wave to go through them and leave the numerical model. Because these boundaries are only approximations of the wave equation, one part of the wave will be reflected and some amount of the energy will be trapped inside the model.

R. Stacey [5] has presented formulation of first and second order artificial boundaries. His boundaries use paraxial approximations. These approximations are based on the idea to separate the wave in two parts, one, which is leaving the model, and the other, which is entering the model. The artificial boundaries based on the paraxial idea deal only with the wave part which takes the energy going out of the model.

Stacey presented three new boundaries. The boundary named P3, uses first order derivatives, while boundaries named P4 and P5 include second order derivatives. In this paper, we compare the performance of P3 and P4 boundaries.

For this article, we built two types of models. The first one represents full space bounded with four Stacey's boundaries and the other simulates half space, bounded with three Stacey's and one free surface boundary. In both models, we used the law of conservation of energy, to estimate the accuracy of the boundaries and how their performance depends on source location.

II. NUMERICAL MODELS

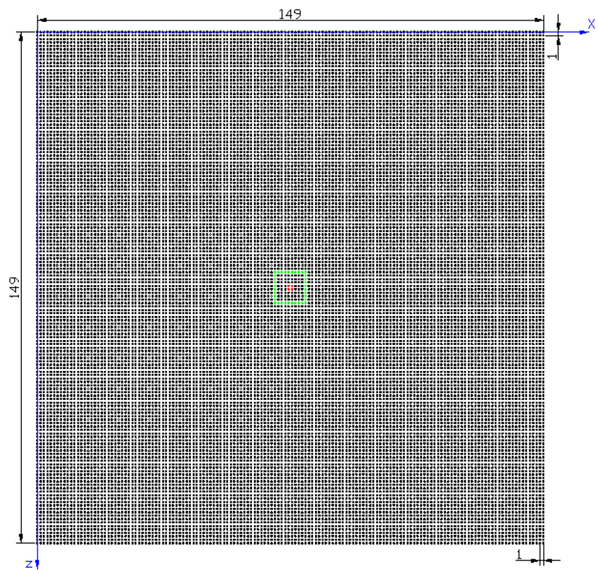

Figure 1. Computational model

The computations in the inner part of the model are done with standard the numerical finite difference scheme explained in [4]. This numerical scheme uses displacement formulation of the wave propagation. The spatial points form square grid with size L = 149m. The distance between the points is 1m in both directions (see figure 1).

The material properties are defined indirectly using the values of the velocities of P- and SV-waves. According to the expressions of both velocities, one can express the demanding material property

$$vp = \sqrt{\frac{(\lambda+2\mu)}{\rho}} \qquad vs = \sqrt{\frac{\mu}{\rho}} \qquad (1)$$

where λ and μ are Lame coefficients (constants) and ρ is the material density of the medium

Both models, the one bounded with four P4 boundaries (full space model), and the other containing the three artificial boundaries and free-surface boundary (half space model), have same material properties. The compressional velocity is vp=250$\sqrt{3}$ m/s, and shear velocity vs=250 m/s. These values are making ratio, which is within the stability margins of the boundaries.

The numerical models are divided in two parts. The inner part is the interior of the model where the source of the wave motion is placed. For simulating point source of cylindrical 2-D wave, four points are used. The source is located in the center of the computational cell and the displacement is prescribed in the four corner points of that cell in both directions. The following law prescribes the displacement at those points explicitly:

$$u = A\sin(\pi t/td) \qquad (2)$$

with amplitude A=50cm and td=0,05s. Each of these points generates radial displacement outward from the source.

The wave equation, which is used in the inner part, simulates the propagation of P-SV waves:

$$\rho\frac{\partial^2 u}{\partial t^2} = (\lambda+2\mu)\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 w}{\partial x\partial z}\right)+\mu\left(\frac{\partial^2 u}{\partial z^2}-\frac{\partial^2 w}{\partial x\partial z}\right)$$
$$\rho\frac{\partial^2 w}{\partial t^2} = (\lambda+2\mu)\left(\frac{\partial^2 u}{\partial x\partial z}+\frac{\partial^2 w}{\partial z^2}\right)+\mu\left(\frac{\partial^2 w}{\partial x^2}-\frac{\partial^2 u}{\partial x\partial z}\right) \qquad (3)$$

where u and w are the displacements in x and z direction respectively.

Kelly et al.[4] presented a finite difference formulation for the wave equation used in this model. The numerical stability of the inner part depends on the time step and point distances. The condition for numerical stability giving the relations between the time step, spatial interval and P and SV velocities of propagation is described in [4].

The quantification of the source (input) energy is done with 36 points from the grid. These points surround the four source points forming a small square, κ, with size 9m. The location of the square is such that intersection point of its diagonals is the fictive source point (the middle of the cell). Using the points of the edges of κ we calculated the displacements in both directions. The derivatives of the displacements are used for the calculation of the input energy (Aki and Richards [1]):

$$E = \rho\alpha\Delta\sum_{k=0}^{(t_p+td)/\Delta t}\sum_{i=1}^{36} v_{i,k}^2\cdot\Delta t \qquad (4)$$

where $v_i^k = \sqrt{\dot{u}_i^2+\dot{w}_i^2}$ is the radial particle velocity of the medium at point i and time step k, ρ is the density of the medium, and α is the velocity of the P-wave. For density of our medium, we take $\rho = 2500kg/m^3$. Belonging area of the point i is $\Delta = h\cdot\cos\gamma$, where γ is the angle formed from the horizontal axis and the line which goes through the source point and point i and $-\frac{\pi}{4}\le\gamma\le\frac{\pi}{4}$. The time needed for the pulse to reach the furthest points of the square is $t_p = 9h/(\sqrt{2}\cdot\alpha)$.

With the sum for all time steps, beginning with t=0 and ending with the end of sine pulse t = t_d, one can approximate the integral over time. It is necessary to introduce additional sum in the equation to approximate the integral over the spherical shape of the wave. This sum collects the calculated energy in each point of the square.

The difference between the two model types is in the periphery and location of the source. Full space approximation model has bounds created with Stacey's P4 boundaries. The intersection of the boundaries is 90^0 which is source of numerical instability. To avoid this, the corners are modified with Stacey's first order P3 boundaries, rotated such that their normal is directed towards the source. The source in this model is placed on half of the length and depth of the model.

The half space model has three P4 boundaries and one free surface boundary on the top. This boundary represents the interface between the ground medium and the air, which means that some of the stresses are equal to zero. Fuyuki and Matsumoto[5] presented formulation for the free surface and for the corners where P4 intersects the free surface. For comparison of the errors obtained with the full space model, first location of the source is same as in the full space model. Additional fifteen positions of the source are chosen to exam the dependence of the error on source position. The sources are grouped in three groups with five points. Each source in certain group has the same x coordinate and different z coordinate. The source points of the first group are located at x=L/6, of the second group at x=2L/6, and of the third group at x=3L/6. In each group the five source locations are with the following depths (z coordinates): z=(L/6, 2L/6, 3L/6, 4L/6, and 5L/6). We consider numerical full space and half space model for each of the fifteen source locations for both P3 and P4 boundaries.

III. RESULTS

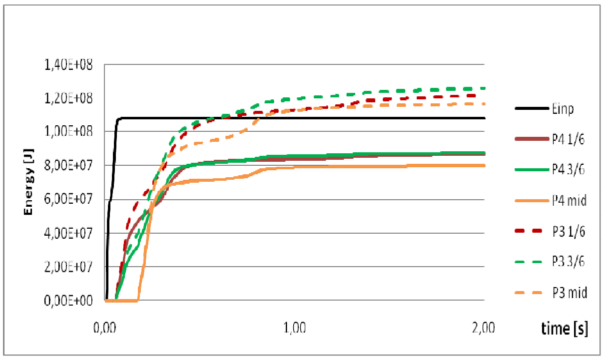

Figure 2. Input and output energy computed with 6 fullspace models bounded with P3 and P4 boundaries.

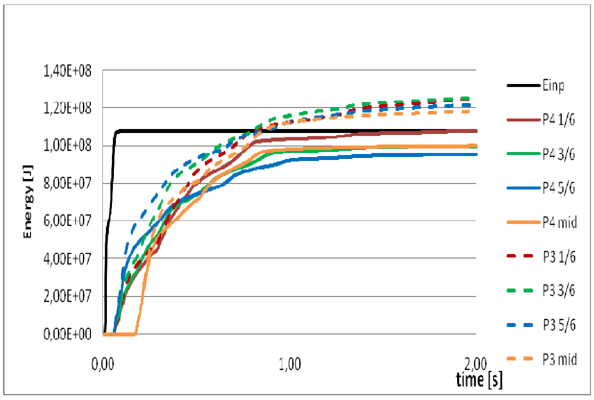

Figure 3. Input and output energy computed with 8 halfspace models bounded with P3 and P4 boundaries and free surface.

Figures 1 and 2 present the cumulative input and output energies as function of time. On figure 2 we present results from six models simulating the full space. Three of them are bounded with four P3 boundaries and three with four P4 boundaries. Each of the models is tested with analysis duration of 2 seconds using time step dt=0,0015(15)s. To show the dependence of the error on source location, we chose having in mind the symmetry, only three source positions. With dashed lines the output energies of the models built with P3 are drawn and solid lines are for the models using P4. The name of the line consists of the type of the boundary and the source location (1/6 means 1/6L in both directions, 3/6 is for source at x=1/6L, z=3/6L and mid is at the middle of the model x=L/2, z=L/2).

Comparing the output energies with the input energy (black solid line) one can conclude that P3 boundaries create output energy, which is greater than the energy emitted from the source. The form of all three dashed lines shows that this energy is continuously growing in time. Because the error is the difference between the input and output, energy divided by input energy, it grows with time running and these boundaries are inapplicable for numerical simulations, which last longer.

One can also conclude that the P3 boundaries are dependent on source location. The green "P3 3/6" line has highest values at the end of the testing time, which means that the coordinates x=1/6L and z=3/6L are the most inappropriate coordinates of the source. Contrary, the orange "P3 mid" gives information that for full space model, bounded with P3 boundaries, the best location for the source is in the middle of the model.

When P4 Stacey boundaries are used, the outgoing energy is less than the input energy. These can be seen from all three full lines from figure 2. One can notice that the error for the full space model with P4 Stacey boundaries is approximately twenty percents, which in many applications is not acceptable. On the other side, analyzing the shape of these lines, it can be seen that at the end of computing time, they are almost horizontal. This behavior shows that they are numerically more stable than the P3 boundaries. The minor increase of the energy is because there is still trapped energy inside of the model, which travels as reflected wave and eventually will exit the model.

The dependence of the energy upon source location shows that when the source is in the middle, the reflection of the energy is highest. For the other two source locations, we obtain almost same results.

Same simulations are performed using half space models and the results are shown on figure 3. It is necessary to introduce two additional source locations, because in half space case there is only one axis of symmetry. These simulations are confirming the conclusions from the full space models. The dashed lines on figure 3, representing the output energy of P3 models, have greater values at the end of calculation time than the black line, which represents the input energy in the model. The shape of the dashed lines again shows the growing intention of the outgoing energy produced by P3 boundaries. Regarding the source location, the best results are obtained with models, which have the source in the middle.

The values of all solid lines in figure 3 are smaller than the values of the input energy. Comparing the shapes of the full lines in figure 2 and figure 3, one can conclude that more time is needed in half space models for these curves to be horizontal. The reason for these is that the interaction between the paraxial boundaries and the free surface boundaries creates artificial numerical sources, which increase the total energy. Figure 3 shows that the results obtained with P4 models are almost perfect, with very small errors.

The accuracy of the boundaries strongly depends on the angle at which the wave front approaches the boundary [2]. Clayton and Engquist have shown that the paraxial approximations give best results when the angle is 90^0. By changing the source location, we can obtain some information how Stacey's boundaries depend on the angle of incidence.

Because the P4 boundaries turned out to be more stable, the difference between the input and output energy, regarding to the source location, will be shown only for the models built with these boundaries.

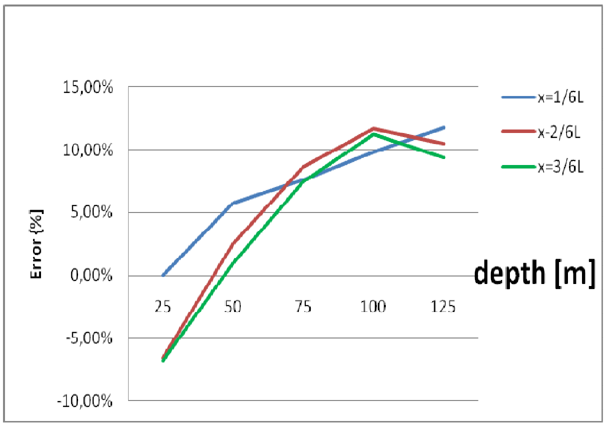

Figure 4. Numerical error computed with fifteen halfspace models with P4 boundaries

Figure 4 shows the dependance of the error on source location. The error is estimated with following equation:

$$e=(Einp-Eout)/Einp \quad (5)$$

Each of the lines in figure 4 presents the errors from the group of five source points located on same distance in horizontal direction as function of the source depth. On the horizontal axis the depth of the source (z coordinate) is shown, while on the vertical axis we show the value of the computed error in percents. At the end of the computing time the error for the model with source at coordinates x=1/6L and z=1/6L is 0,01%. Highest reflections the P4 boundaries give when the source is located at point x=2/6L and z=4/6L (100m). It can be seen from Fig. 3 that for shallow location of the source, z=L/6, the smallest error (e ~ 0) appears in the case when the source is the closest to the vertical artificial boundary, x=L/6. For the location of the source x = 2L/6 and x = 3L/6 and for the above its depth, the error is the same e ~ 6.5%. As the source becomes deeper, z = 2L/6, the error is smallest for x=3L/6 and its value is smaller than 1%. For z = 3L/6 = 75 m, all curves have almost the same error, about seven percents. For depth of the source, z = 4L/6 = 100m, the curves representing the x coordinate of the source, x = 2L/6 and x = 3L/6, reach the maximum error of about eleven percents. Finally, at the deepest considered location of the source z = 5L/6 = 125m, the closest source to the vertical boundary (x = L/6, z = 5L/6) reaches its maximum error.

The negative values of the error are showing that the input energy is exceeding the values of the input energy.

IV. Conclusions

We gave evaluations of the accuracy of the first order, P3, and second order, P4, paraxial approximations proposed by Stacey. The evaluation is performed by comparing the input and output energies of the model as property, which can be, quantified [3].

Using the law of conservation of energy, we have shown that the outgoing energy at models with P3 boundaries is larger than the emitted energy in both full space and half space cases. In addition, we showed that the outgoing energy in the models with P3 boundaries grows monotonically with time, revealing certain order of instability. From this, we can conclude that P3 boundaries cannot be used in long lasting numerical computations.

On the other side, the models with P4 boundaries show stable behavior. Until the wave reaches the artificial-boundary points, the cumulative outgoing energy is zero. While the wave is exiting the model, the cumulative outgoing energy grows. When the wave completely leaves the model, the cumulative outgoing energy becomes constant with negligible growth, in contrast with the models with P3 boundaries.

From Figure 2 it can be concluded that the full space models with P3 boundaries, although unstable, in short analyses give smaller error than the full space models with P4 boundaries. In long lasting analyses, the models with P3 boundaries reveal unstable behavior.

For the half space, it was shown that the models with P4 boundaries besides being stable are more accurate than the models with P3 boundaries (Figure 3). This is the reason why one should model the half space problems with P4 Stacey boundaries rather than with P3 boundaries

The error produced by both type of approximations is dependent on source location. The values of the error can vary up to twelve percents (Figure 4). Varying the source location with the depth, it was shown how the error varies depending on the x – coordinate of the source location. For shallow sources, the source closest to the vertical boundary gives the smallest error, while with increasing the depth of the source, the source farthest from the vertical artificial boundary gives the smallest error.

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EDUCATION IN A VIRTUAL LEARNING ENVIRONMENT

G. Jotanović, G. Jauševac
Faculty of Transport and Traffic Engineering, Doboj, Republic of Srpska, Bosnia and Hercegovina
gjotanovic@yahoo.com

Abstract - Virtual learning environment has a great potential that can be used to access a large amount of information, new services and all this is accomplished in a short time regardless of the physical distance information sources. Professors, students and administrative staff in schools and at University running virtual communities are in a position to constantly monitor new developments in the field of education. Constant contact with colleagues around the world teachers become familiar with the new techniques of lectures, are underway with news from the field of work, it allows them to provide their students the latest information. In addition, students can to expand their knowledge by organizing the virtual community.

I. INTRODUCTION

Virtual reality or virtual world was first mentioned in the classroom since the 1980s [1]. Virtual learning environment-(VLE) can be identified by the following characteristics [2]:

- Virtual learning environment is designed as a single information space.
- Virtual learning environment is the social space of educational interactions.
- Virtual reality can be presented in the form of text or a 3D reality.
- Students are not only actors, but also consultants in the creation of virtual space.
- Virtual learning environment is not only limited to the distance education has already enriched the activities inside the classroom.
- The virtual learning environment can integrate heterogeneous technologies and pedagogical approaches.
- Most virtual environments overlap with the physical environments.

However, regardless of the resistance of the creators of the system and the development of many educational facilities customized virtual worlds, this kind of teaching has never become a leader. On the contrary, we can say that the number of virtual environment for education decreases. It can be concluded by the fact that some well-known, virtual education environment no longer exist. In addition, we are exploring the virtual world and trying to find interesting or useful educational sites that have previously visited cannot find them. Their existence is stopped and probably is idle and located in a dusty corner of a server. In addition, a recent analysis of research shows us that still many new technologies are disappearing. With the cessation of the use of virtual world, stops and their maintenance and development by dedicated groups of users and innovators [3]. The question is, why so much effort is put into developing something if we "it" just throw away, having invested considerable resources in the virtual world for learning, it could be expected that its use be hyper productive [4].

However, we hope that there is a future for teaching and learning with the virtual world. Groups of users and innovators who participated in the virtual learning environment feel that they are important for learning and teaching. Individuals and groups around the world are doing research supported by empirical evidence about the value of tuition in the virtual world.

II. VIRTUAL LEARNING

Virtual learning is a process of acquiring knowledge, which does not require a stay in the classroom; time limited lectures, homework, and study at night and so on. The aim of this system of learning is to allow students to the simpler and more flexible way to get to know. The students themselves choose when and how to learn and make their own schedule of learning at the same time can choose the highest quality teachers, teaching materials and textbooks.

Virtual learning is contrary to the traditional system of learning. Schank [5] tried to explain the key points that would make the teaching process should apply 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.

Virtual learning allows users to gain through your computer from your room or office certain knowledge, diplomas and to take their tests as well as lifelong education.

Within the virtual education, there are three types of learning interaction: student-teacher, student-student, student-courseware [6]. The interaction between students and teachers is done using virtual classroom teachers. Which represents an application that is located on the server and can contain a database of questions necessary for communication with the student? The connection is done through the user's Web browser student-student interaction is done through the virtual community of students. Efficient interactive material and high-quality sources of information the task of the team of *experts* who devise a course in cooperation with skilled supervisor *tutor* that allows interaction between students and a courseware. What each virtual classroom must offer students is good communication software and simple instructions for use of the offered technology.

III. Virtual Schools

The concept of virtual education is first mentioned in the mid-1990s and used as a synonym for Distance Learning. By definition, the virtual school is an entity or administrative body authorized by the state that provides distance courses usually via the Internet [7].

Virtual schools can be considered a "new wave" in technology based on proven methods of delivery Distance Learning. Virtual schools are defined as educational organizations that offer education through the Internet, or method of Web-based learning [8].

Student in the future to study in virtual environments where they will be using artificial intelligence to determine the student's learning style and to deliver course materials especially tailored to the student's needs [7].

Virtual programs tailored for virtual schools are designed to solve a variety of problems adapted to the educational needs of students. Decisions, design and how the programs fit into the range of available options affect the level of educational equality and programmatic access to a virtual school offers students.

Many virtual schools are not equal to the education market in relation to the state schools. State schools are financed from the funds of the Ministry of Culture and Education therefore must be implemented, and education policies accordingly. Most states also required in public schools to create their own education policies.

Virtual School to be competitive on the educational market in their programs must have [9]:

- The policy of non-discrimination.
- They must operate in accordance with this policy.

At all, public schools and universities working toward educational programs Distance Learning are available only to those pupils / students who have their own computers and enough money to pay for programs delivered or are not truly available to everyone. Any virtual education program that operates in the public school has a responsibility to deliver programs to students who do not own computers or who have not previously had the opportunity to learn in an online environment. Virtual School has special attention to students with disabilities. Students with a disability may have difficulty with access to online content if programs are not specifically designed for them, such programs are quite expensive. Virtual Schools have curricula and technology adapted to people with disabilities and it is much cheaper because it can find application in much face the same problem. Thus eliminating the discriminatory policy in relation to students with a disability in virtual schools.

IV Virtual Parent Meeting

In order to control and properly directed N-generation it is necessary to act as a "cyber" parents [10]. Control of success of students coming to school for working parents an additional burden. Lately, that is not a big problem under the assumption that you have basic knowledge in "surfing" the Internet. Parents can visit the website of the school that their child attends and follow the successes and failures of their own child.

Figure. 1. Website high school "G.B.Garbin", Italy.

Web page in Figure 1 is not only a high school "G.B.Garbin" in Italy, but can serve to parents monitor student success at school subjects, to control absenteeism, students and all other school-related activities for certain students [11]. Website is updated once a week so that parents can always be during school events. To log into the students' records need to know the password and password students, see Figure 2.

Figures. 2. Online registration for parents.

The admission of pupils to the high school code and password are assigned to parents on a sheet of paper. Data from the student's files are protected so that alteration of any kind is not possible, except by the administrator applications.

Each virtual visits parent this site is registered and has the same value as the presence of the parents' meeting. This kind of cooperation between parents and teachers raises many pedagogical issues. Does a virtual parent-teacher conference can replace the classic parent-teacher conference? How many students' behavior affects student achievement? From the point of time, we will have studiously research virtual means of communication between students, parents and teachers.

V. Method

After many years of work experience in the educational process in the Republic of Srpska (Bosnia and Herzegovina), we noticed that teachers work very rarely or never use the virtual learning environment and artificial intelligence environment. Prompted by the observations we found that for the further development of the teaching process necessary to determine why the teachers do not use modern didactic information innovations in daily practice and examine the attitudes of teachers about the importance of the use of modern information-didactic innovation in the schools of the Republic of Srpska (Bosnia and Herzegovina). The research was conducted with the idea to examine why the introduction of modern information didactic innovation in primary education system in the Republic of Srpska (Bosnia and Herzegovina) so slow and cumbersome. With a tendency to be in the teaching process of elementary, secondary school and university education introduce modern learning environments such as virtual learning environment and artificial intelligence environment.

The study was conducted on a sample of 661 teachers from 15 primary schools in the Republic of Srpska. The sample includes primary school teachers and subject teachers, Figure 3.

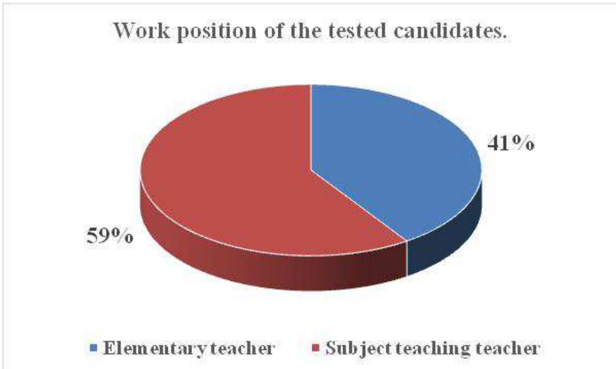

Figure. 3. Work position of the tested candidates.

The survey was carried out according to pre-established procedures, and ensures relevance of the data obtained with respect to the complexity of the case studies. Based on the theoretical analysis of similar studies and consultation of the available literature, we have created tools that we use in research. In the study, we used the method of theoretical analysis. Scale test sample was built modeled on the Likert scale and is intended to test attitudes about the importance of the use of information-didactic innovation in the schools of the Republic of Srpska (Bosnia and Herzegovina) [12].

VI. RESULTS AND DISCUSSION

With statistical and data analysis we obtained results and display them Figures 4 and 5. In order to understand better why the educational environment in the Republic of Srpska do not use virtual learning environment, we analyzed the chronological age of the respondents, see Figure 4. From Figure 4 we see the attached that most of the teachers age of (46 to 55) years, which indicates that they in their education did not have an opportunity to study modern educational environment. Virtual School is applied in the world of 2000s. The situation with us is something different. According to Figure 5, the highest number of teachers (16 to 30) years of experience in teaching so that they were able to use virtual learning environment in their pedagogical education.

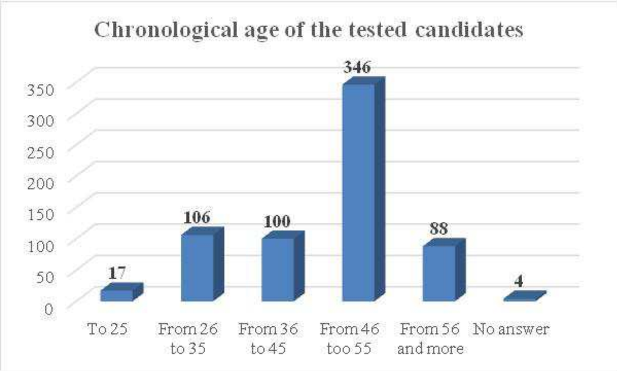

Figure. 4. Chronological age of the tested candidates.

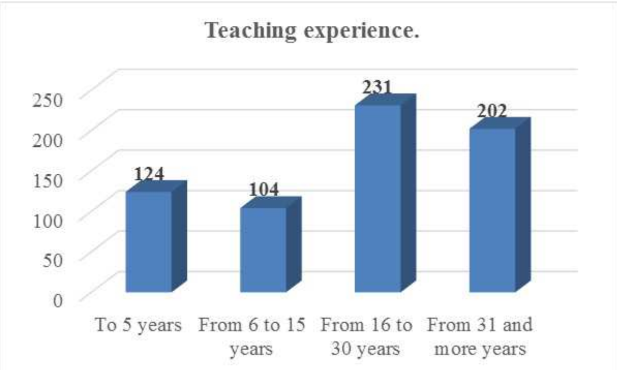

Figure. 5. Teaching experience.

In Table I. shows the responses of teachers to the question: "Do you need the following didactic-information innovations in teaching?". From Table I, we can conclude that the majority of respondents used an overhead (85.792%) in their daily work as expected according to the chronological age and teaching experience of the respondents. From Table II. and Table III. We see the attitudes of teachers would significantly change with the individual use of didactic information innovation in everyday teaching practice and if the school could provide modern didactic and innovative means and financially stimulate teachers. The reason for this is probably insufficient training of teachers to use modern didactic and innovative resources and virtual learning environment. Such learning environments would be necessary in the near future is implemented in the educational system of the Republic of Srpska (Bosnia and Herzegovina) to catch up with the development of educational systems in the world.

TABLE I. TEACHERS NEEDS FOR INTRODUCTION OF DIDACTIC-INFORMATION INOVATION.

Do you need the following didactic-information innovations in teaching?	**AS**	**Yes**	**Not sure**	**No**	**No answer**
		3	2	1	0
Graphoscope	2,674	85,792	2,300	5,413	6,495
Computers / Internet	2,376	70,771	7,848	9,608	11,773
Projectors	2,338	67,524	11,773	7,713	12,991
Compact discs	2,146	58,728	13,938	10,555	16,779
Cameras	2,057	53,451	15,291	14,750	16,509
Multimedia systems	1,739	34,777	26,793	15,968	22,463
Virtual learning environment	1,560	22,869	33,288	20,839	23,004
Artificial intelligence environment	1,555	21,651	34,777	20,974	22,598

TABLE II INTERNAL TEACHERS MOTIVATION FOR APPLICATION OF DIDACTIC-INFORMATION INNOVATIONS.

If in your shool existed didactic-information innovations, would you apply them in teaching?	**AS**	**Yes**	**Not sure**	**No**	**No answer**
		3	2	1	0
Graphoscope	2.77	89.58	2.84	2.70	4.87
Computers / Internet	2.42	69.41	14.07	5.95	10.55
BIM projector	2.40	67.65	15.42	5.14	11.50
Cameras	2.35	65.08	16.64	6.49	11.77
Compact discks	2.25	60.48	18.94	6.35	14.20
Multimedia systems	1.92	38.83	31.93	11.36	17.86
Virtual learning environment	1.70	26.11	37.48	16.91	19.48

TABLE III EXTERNAL TEACHERS MOTIVATION FOR APPLICATION OF DIDACTIC-INFORMATION INNOVATIONS.

If you were stimulated would you apply didactic-information innovations in teaching?	**AS**	**Yes**	**Not sure**	**No**	**No answer**
Graphoscope	2.72	87.68	3.51	2.43	6.35
Computers / Internet	2.51	75.37	9.87	4.46	10.28
Cameras	2.39	68.20	15.56	4.05	12.17
Compact discks	2.33	65.89	15.15	5.00	13.93
BIM projector	2.33	65.62	16.23	4.33	13.80
Multimedia systems	1.96	43.70	27.19	11.36	17.72
Artificial intelligence environment	1.77	32.47	32.47	14.88	20.16
Virtual learning environment	1.77	31.66	33.96	14.74	19.62

VII. Conclusion

Institutions such as the Ministry of Education should allocate more funds for the training of teachers in schools. Such investments would provide to the educational process in schools and universities apply modern teaching platforms such as LMS (Learning Management Systems) and VLE (Virtual Learning Environment). When trained in the use of the said technology could have a function advisors or to assist those who want to engage in modern learning process enriched with new technologies and resources.

Often in the "real" world, build schools and colleges as well as the magnificent new building to be used by many generations of teachers, pupils and students. Virtual learning environments are not material and do not require physical space for existence. This learning environment has the ability to re-use and in order not to require any special maintenance. Classical learning environments have a limited life span in most cases are not fully utilized because virtual learning environments have a chance to hold as a resource in the future systems of education.

There is still hope that in the future education system in Bosnia and Herzegovina begin to follow global trends at the level of application of VLE and thus provide a powerful educational tool for the education of new Net generation.

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APPLICATION MODELS OF COMPUTERS AND EDUCATIONAL SOFTWARE FOR TEACHING

Ž. Namestovski[*], A. Buda[**], M. Takács[***]
[*]University of Novi Sad, Teacher Training Faculty, Subotica, Republic of Serbia
[**]University of Debrecen, Debrecen, Hungary
[***]Óbuda University, Budapest, Hungary
zsolt.namesztovszki@magister.uns.ac.rs, buda.andras@arts.unideb.hu, takacs.marta@nik.uni-obuda.hu

Abstract - The intensive use of computers in everyday life and at schools started from 1990s. At that time use of satellite antennas started also, and next to the state channels also foreign channels appeared. Children were changing channels, culture, states by pressing the button and that was very attractive to them. Ideological and pedagogically useful emissions were replaced by aggressive and senseless emissions. Computer appeared in this environment and immediately received a significant position in education.

I. INTRODUCTION

Teachers reacted to this new assisting tool in three ways (Raschke, 1998):

- The first group was afraid of the new way of education. They felt that the computer could significantly change the role and relationship between students and teachers. They were against this sort of technique and against the computers. Reason for this kind of behavior was the great fear of handling the computer, which seemed very complicated. They thought they would never be able to learn to use the computer. Their knowledge will become obsolete and they will not be able to keep pace with modern educational processes, they will not have time to learn along with the obligations in the school.
- The second group was delighted with the appearance of the computers and computer systems in schools. They learned quickly (or already knew) to use computers and some programming language (at that time Basic ruled the market). From this group some individuals have constructed the first primitive educational software (Commodore computers were most frequently used).
- The third group was the largest. Passive expected if the implementation of computers in teaching would happen. They have already experienced programmed teaching, school television, and teaching reform. In addition, when it becomes clear that the computer is more than just a modern toy for children, others were far ahead in terms of knowledge.

A few years ago, the Commission for Education of the European Union carried out a survey on the application of computers by teachers. One set of the question requested the answer to the question: “Why teachers don’t like computers?” The most common responses were:

- Fear of change and of new way of education
- “I am technically illiterate!” – spiritual barriers to learning
- “I am (maybe) unnecessary here?!” – the inability to adapt to the new role of teachers
- Computer competency – advantage of students seems unattainable
- “Everything is in English?!” – fear of domination of other languages and other cultures
- Fear of alienation of personality in education.

PC computers and educational software in schools is increasingly used not only as a teaching tool, but also as a learning environment. Teachers need to know how to use computers, not only when preparing for the class, but also during the class. They must possess basic IT and telecommunication knowledge. Only such teacher can prepare student for the challenges of the information society in which he lives. The teacher must know how to use an endless amount of information. To collect this information, the primary mean is computer and modern telecommunication systems. In addition, the most significant source is the Internet, as a global computer network. The Internet is a source of endless information in the form of images, text, videos and multimedia, which can be used for teaching process.

The computer in the classroom has multiple functions. It can be used when practicing motor skills by using the mouse and keyboard. It is also used as multimedia and interactive teaching means. PC can replace the largest number of teaching aids (TV, VCR, overhead projector, pontiff, recording tapes) (Námesztovszki, 2006).

Educational software, which is used in teaching, can be divided into:

- Programs for motor skills development
- Programs for training – forming habits, abilities of students. Constantly inform students about the results, reinforce good answers, evaluate the success of students.
- Programs that impart new knowledge – learning programs
- Programs for solving various problems (detection programs) – the student works independently, and tries to resolve problems given by computer

Models of computer application can be conceptualized in education, with its peripheries, where the focus is the purpose of the application. In this division, the main models are:

- Application of the computer as assisting tool (for teachers): production and printing of tests, calculation of the averages, schedules production, calendars, etc.
- Application of computers as a source of information needed for maintenance of the class and independent learning (for students and teachers): the use of on-line encyclopedia, search sites. On the Internet most of the knowledge of known to the humankind is available, and above all the latest innovation-information. For the provision of these facilities hardware, software, Internet access, competence and knowledge of some foreign languages are necessary (English is the language of the Internet).
- Application of the computers as a tool for communication (for teachers): electronic mail, chat, video conference, distant learning.
- Application of computers as a means through which we achieve programmed teachin (for pupils and teachers): hypermedia software.
- Application of computers as a teaching tool (for students and teachers) by which we display images, sound, video, multimedia. The computer can be used instead of traditional teaching aids (slide projector, pontiff, overhead projector, tape recorder, CD player, DVD player).
- Application of computers as a tool for displaying multimedia presentations: which is a new form of communication in the classroom, and it integrates display of text, tables, graphs, images, sound, animation, multimedia, hypertext, interactive content and complete software tools.
- Application of computers as an interactive means: by which we realize interactive individual and group work, with the help of a projector and electronic table.

Another way of building models for the use of computers in the educational process is based on the extent and intensity of use. This division differs:

- The traditional model: dominated by classical methods, in most of the cases by frontal work. Classical teaching material with classical pedagogical and psychological principles is used. Classrooms are without a computer, and instead of them printed material and classical models of display are used. Location of the teaching is classical classroom. The main disadvantage of this model is absence of the modern teaching tools. The advantages of this model are simplicity of applied educational materials and absence of technical problems.
- Combined model: applies only one computer and projector to show presentation that contains text and images. Frontal form of work dominates. Teaching happens in classic classroom, equipped with computer and projector. For combined model computer is a teaching tool. The main disadvantage of this model is lack of multimedia and individual work (on a

computer). Advantage of the model is computer application with moderate intensity.

- Multimedia and interactive model: multiple computers are applied (if possible, each students uses an individual computer), as well as projector and interactive whiteboard. The emphasis is on the presentation of multimedia, individual work and interactive methods (for electronic board and for computer). Active learning and individual learning are dominant, all under the coordination to teachers. Frontal part of the class is motivation and task presentation. Class is held in computer room or in media room. For multimedia and interactive model computer is a teaching environment. The disadvantages of the model are the possibility of technical problems and long preparation for class. The advantages of the model are individual work, possibility of applying multimedia and interactive methods.

The degree and the level of computers implementation in teaching activities, in addition to the structure and objectives of the education system mostly depends on teachers, who often resist changing.

The reasons for the resistance to the changes are divided as:

External barriers, which include the lack of:

- Hardware access
- Software access
- Time to plan a new form of teaching
- Technical support
- Support of the management of educational institutions

Internal barriers, which include the lack of:

- Beliefs about the quality of teaching
- Beliefs about the advantages of technology
- Educational models
- Unwillingness to change

The elimination of external barriers is possible with investing in the educational system, by equipping schools with modern computer tools.

Elimination of the internal barriers is process that is more complex. The key to success is in the minds of the teachers. Possible solutions to this problem are organizing of professional seminars, training courses, motivating teachers, detail investigation of the issues, and presenting the obtained results.

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