UNIVERSITY OF NOVI SAD
TECHNICAL FACULTY
"MIHAJLO PUPIN"
ZRENJANIN

ITROCONFERENCE 10

INFORMATION TECHNOLOGY AND EDUCATION DEVELOPMENT

PROCEEDINGS

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ZRENJANIN, June 2019

UNIVERSITY OF NOVI SAD
TECHNICAL FACULTY ”MIHAJLO PUPIN”
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Jelena Stojanov, Ph. D, Assistant Professor

Proceedings editor:
Marjana Pardanjac, Ph. D, Professor

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Ivan Tasic, Ph. D, Professor;
Dusanka Milanov MSc, Assistant
Dragana Draskovic MSc, Assistant

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With this publication, the CD with all papers from the International Conference on Information Technology and Development of Education, ITRO 2019 is also published.

INTRODUCTION

International Conference on Information Technology and Education Development (ITRO 2019), was held the jubilee tenth time. Since the very beginning, the conference has been connecting science, profession and experiences in education. Information technologies influence educational processes and student achievements. Contemporary topics relate to Interactive EBooks and electronic Teachers logbooks. Thematic fields of the conference are alined with general, but olso with national trends in education:

- Theoretic and methodology questions of contemporary pedagogy
- Digital didactics of media
- Modern communication in teaching
- Curriculum of contemporary teaching
- E-learning
- Education management
- Methodic questions of natural and technical sciences subject teaching
- Information and communication technologies
- Dual education.

The conference work was contributed by plenary lectures covering various aspects of ICT in education development:

- *Digital transformation of educational system in Higher Education*, Branko Perišić, Faculty of Technical Sciences, University of Novi Sad;
- *Security issues of e-learning system*, Igor Franc, E-security, Belgrade;
- *From E to ES teacher logbooks*, Žarko Mušicki, primary school "Žarko Zrenjanin", Novi Sad;
- *Canvy, The Thrue Story of Mobile App*, Marius Marcu, Politechnica University of Timisoara, Romania.

The Proceedings containes 59 articles based on research and scientific work in the field of information technologies in education.

The conference was financially supported by the Provincial Secretariat for Higher Education and Scientific Research, Novi Sad. The Technical Faculty "Mihajlo Pupin" has provided the necessary technical support.

The ITRO Organizing Committee would like to thank to the authors of articles, reviewers and participants in the Conference who have contributed to its tradition and successful realization.

Regards until the next ITRO Conference,

Chairman of the Organizing Committee

Jelena Stojanov

We are very grateful to:

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for donated financial means, which supported publishing of the Conference Proceedings and organizing of the Conference.

CONTENTS

SCIENTIFIC PAPERS

SCIENTIFIC PAPERS

Comparison of Information Security Awareness of Mechanical Engineering and Safety Technical Engineering students at Obuda University

G. Kiss, Z. Rajnai
Obuda University/Institute of Mechanical Engineering and Safety Sciences, Budapest, Hungary
kiss.gabor@bgk.uni-obuda.hu, rajnai.zoltan@bgk.uni-obuda.hu

Abstract - In this article we examine the password usage habits of the Mechanical Engineering and Safety Technical Engineering students. We have prepared a questionnaire for students asking them about the complexity of their passwords used in Internet services. The students filled out the questionnaire at the first week at the University to see the choosing of the faculty have influence on the Password Habits or not. Every students attended on an information security course and the students filled out the questionnaire again. By evaluating the two questionnaires by faculties we were looking for an answer, if the traditional educational method (table, PowerPoint based lecture) supported with videos showing how fast the passwords can be deciphered with home computer, leads to more secure passwords usage by students. After the statistical analysis we can see the choosing of the faculty do not have any influence on the Password Habits of the entering student. The results showed that significant changes were made only in the way the students stored their passwords, otherwise we did not make any changes in other aspects under review. To achieve more secure password usage for students, we need to choose a different didactical method.

I. INTRODUCTION

The young generation use smartphones, tablets to keep in contact with friends at home, on public transport, in the school etc. They use different communication forms on the internet like social networks, chat rooms and so on. These applications are protected by password authentication system to keep save the data of the users. We were interested for which systems find the entering mechanical engineering and safety technology students important in everyday life and what kind of password use for protecting the information. We see almost in every month in the news a service provider was attacked again by hackers and the have put the username and the passwords on the Internet. The success of the attack depends on user error mainly. On the one hand this research is important to see how complicated passwords use the students and on the other hand how deep information security course they need to protect the important information in the near future at the work. The students filled out an information security awareness questionnaire at the first week at the University. The students had to say, which communication systems are more important, how long password they are using by the most important systems like e-mail, community sites, and so on, how complicated is the used password, how often change the students these passwords. Are they using same passwords by different systems or one same password?

The aim of this research is to analyze the Password Habits of the freshmen mechanical engineering and safety engineering students. The students from these two groups will use different ICT tools in their professional life after graduation; the mechanical engineering students work mostly with designer ICT tools, but the safety engineering students use mostly security systems.

Our research focused on whether the choosing of the faculty have influence on the Password Habits or not and the traditional educational method has any influence on the Information Security Awareness of the entering students or not.

II. ANALYSING OF THE PASSWORD HABITST OF THE FRESHMEN STUDENTS

In the questionnaire apart from the personal data questions we have asked about the ICT tools they own; the time spent using Internet; their web service use and its importance; and their user password habits.

Our questionnaire was filled out by 82 of the 271 mechanical engineering students (30.3%) and by 62 of the 74 safety engineering students (83.8%).

The questionnaire had a wide range of variables (nominal measurement level). Some of these (characterized by sequence of interest) we coded as higher ordinal measurement level variables (e.g. education, village size etc.). In case of password usage we gave higher score (rank number) for more cautious and safer passwords and lower score for the risky ones. (E.g. The passwords dissimilarity indicator variable was given one point for the identical passwords, 2 points for partially same passwords (with identical area), 3 points for a completely different passwords).

We treated these variables as range variables where the comparisons of the different categories (dissimilarity tests) were performed.

The majority of the students have own PC/laptop and smart device (portable with internet connection).

More than third of the mechanical engineering students (35.4%) spend with Internet activity 1-2 hours, more than half of them (53.7%) 2-5 hours on the weekdays, at the weekend the 14.6% of the respondents spend more than 5 hours with internet activity. The safety technology students spend more time with internet activity, on the weekdays (30.6%) spend with Internet activity 1-2 hours, half of them 2-5 hours and 14.5% more than 5 hours, at the weekend the 30.6% of the respondents spend more than 5 hours on the internet.

More than two third of the students (73.2% of mechanical, 71% of safety technology) do not have ECDL exam. It is important, because the ECDL have selectable course in information security, but the big part of students do not had chance to choose it before have gone to the university.

The used passwords for internet services marked as important (4 or 5 points rated) are for all services identical by 6 people of all 82 mechanical engineering students (7.3%) and 9.7% by the safety technology students (Table I.), in their case it is enough to steal the password from one of the services and have already access to all other internet service used by them and also all sensitive information which those might contain.

TABLE I. THE TYPE OF THE USED PASSWORDS BY FACULTY

Type of passwords	*Mechanical E. St.*	*Safety T. St.*
Identical	7.3%	9.7%
Have permanent part	50.0%	53.2%
Totally different	42.7%	37.1%
Total	100.0%	100.0%

Thirty-five respondents (42.7%) use different passwords by the mechanical engineering students and 37.1% by the safety technology students, it is somewhat very positive as password obtained in one place cannot be used to access another service. Forty-one mechanical engineering students (50.0%) have a joint permanent part of passwords, from which one can gain easier approach to generate the appropriate amendments to other services' passwords. E.g. if someone's Facebook password is „passwordfb", you can easily make „passwordgm" in Gmail. The situation is same by the safety technology students, 53.2% of them use passwords with permanent part on different internet services. I means, the majority (92.7% of mechanical engineering students and 90.3% of safety technology engineering students) is cautious not to use identical passwords [5].

According to the table (Table II.) we can see that how often change the students the used passwords.

TABLE II. THE FREQUENCY OF THE CHANGING PASSWORDS BY FACULTY

The frequency of changing passwords	*Mechanical E. St.*	*Safety T. St.*
do not change	18.3%	9.7%
if someone found it out	40.2%	41.9%
annually or less frequently	23.2%	21.0%
every 3-6 months	15.9%	22.6%
every 1-2 months	2.4%	4.8%
Total	100.0%	100.0%

Fifteen respondents (18.3%) of the mechanical engineering students does not change their password even they suspect that someone found it out. Thirty-three respondents (40.2%) change the password only if they think someone found it out; 19 respondents (23.2%) change the password annually or less frequently, 13 respondents (15.9%) change it every 3-6 months, and just 2 respondents (2.4 %) every 1-2 months. The situation by the safety engineering students almost same.

We estimated the number of characters in passwords given by the respondents based on class means (assuming equal class-lengths we gave the lower and upper class values).

TABLE III. THE NUMBER OF CHARACTERS IN PASSWORDS BY FACULTY

The number of characters in passwords	*Mechanical E. St.*	*Safety T. St.*
<8	4.9%	0.0%
8-10	43.9%	50.0%
11-13	26.8%	25.8%
14-16	13.4%	11.3%
>16	11.0%	12.9%
Total	100.0%	100.0%

Just four respondents (4.8%) use less than 8 character long passwords by mechanical engineering students, 43.9% use 8-10 character long passwords, 26.8% use 11-13 character long passwords, 13.4% use 14-16 characters by passwords and 11% use more than 16 character long passwords (Table III.). Nobody use less than 8 character long passwords by safety technology students, 50.0% use 8-10 character long passwords, 25.8% use 11-13 character long passwords, 11.3% use 14-16 characters by passwords and 12.9% use more than 16 character long passwords. We can not see big different in this case too.

We investigated also the quality and the strength of password and analyzed the characters used in the selection of password.

TABLE IV. THE QUALITY OF THE PASSWORDS BY FACULTY

The quality of the passwords	*Mechanical E. St.*	*Safety T. St.*
a..z	0.0%	1.6%
a..z, A..Z	1.2%	0.0%
a..z, A..Z, 0..9	73.2%	67.7%
a..z, A..Z, 0..9, spec. (>#&{, etc.)	25.6%	30.6%
Total	100.0%	100.0%

From the participants in the survey nobody used only lowercase letters in passwords and just one respondent used the combination of upper and lowercase letters by the mechanical engineering students. 60 respondents (73.2%) used combination of uppercase, lowercase letters and numbers, which is required by some services; 21 respondents (25.6%) used uppercase letters, lowercase letters, numbers and other characters too. From the safety technology students in the survey 1 respondent use only lowercase letters in passwords, nobody use the combination of upper and lowercase letters. 42 students (67.7%) used combination of uppercase, lowercase letters and numbers and 19 respondents (30.6%) used uppercase letters, lowercase letters, numbers and other characters too (Table IV).

We focused on the password handling too. From 80 respondents 37 (45.1%) remember their passwords without writing it down; 22 respondents (26.8%) saves his passwords to the browser's cache, 13 respondents (15.9%) note some passwords, 6 respondents write their password down by the mechanical engineering students and just two respondents (2.4%) use Password Manager Program. Nearly half of the mechanical engineering students remembers their passwords or store the password with Password Manager Program, it means they following the safe way by password handling. More than 20% of the respondents note some passwords or all of them it has the high security risk, when somebody find the notes and 22 mechanical engineering students store the password with the browser.

Almost two third of the safety technology students (59.7%) remember their passwords and just 3.2% of them note some (Table V.)

TABLE V. THE QUALITY OF THE PASSWORDS BY FACULTY

Password handling	*Mechanical E. St.*	*Safety T. St.*
I save the passwords to the browser's cache	26.8%	29.0%
I write the password down	7.3%	6.5%
I note some passwords	15.9%	3.2%
I remember the passwords	45.1%	59.7%
I use Password Manager Program	2.4%	1.6%
Total	100.0%	100.0%

A. Comparison the of the Password Habits by Faculty

We get the results in different tables and we can not decide it, is it any difference between the entering students at Obuda University. It means we have to make more analysis. We have two independent samples so we could use the Mann-Whitney-Wilcoxon test for 2 samples [6]. We used the Mann-Whitney independent sample U test of SPSS to compare the means of scores taken by the students. Monitoring was held on p=5% significancy level in the whole analyzing process.

TABLE VI. THE RESULTS OF MANN-WHITNEY-WILCOXON TEST QUALITY OF THE FRESHMEN STUDENTS BY FACULTY

Password habits	*P*
Difference of password	0,454
Password changing	0,149
Password length	0,835
Character type of password	0,545
Password handling	0,451

We calculated the mean scores by items and also calculated the difference between them grouped by countries. Then we can made analysis process with Mann-Whitney U test.

According to the table (Table VI.) we can see the Mann-Whitney U test do not show any significant difference between the 2 group of students by Password Habits, ($p>0.005$) it means the entering student do not have different Password habits, the choosing of the faculty do not have any influence on it.

III. Comparison the of the Password Habits by the Mechanical Engineering Students after the Infromation Security Course

After the information security course filled 38 mechanical engineering students the questionnaire again. In the next we examine the frequency of each password features before and after the information security course.

A. Frequencies of the password features before and after the course

Choosing passwords is one of the most important factor of protecting our data, in case we are using the same passwords for different systems, if attacker successfully secures our encrypted password from one of the systems, he can log in to other systems on our behalf.

More than 42% of students used completely different passwords before the course, and 50% used partially identical passwords. After the information security course, surprisingly, the number of users of completely identical passwords grew, the number of users of different passwords decreased (Fig. 1).

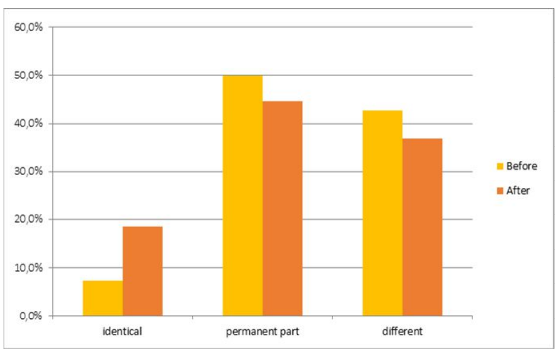

Fig. 1. Password diversity before and after information security course

On contrary, at the end of the course the number of those who did not change the password reduced from 18.3% to 10.5%, comparingly to case of suspicion that the password was recognized by somebody else (from 40.2% to 50.0%) (Fig. 2.).

The number of those who have changed the password every 3-6 months increases from 15.9% to 18.4% and those with frequency every 1-2 months from 2.4% to 5.3%. But it is still not very strikingly positive change.

Before the information security course 4.9% of students used passwords with less than 8 characters, and at the end of the course none, so that is a progress.

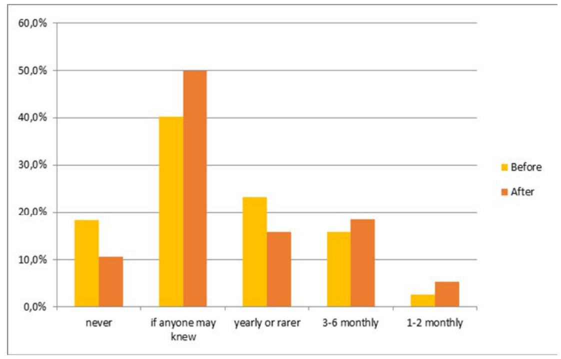

Fig. 2. Password change habits before and after the information security course

The biggest change was detected in the number of users using passwords with 8-10 characters, there is a growth from 43.9% to 57.9%. In case of longer passwords, a slight loss of proportion is observed (Fig. 3).

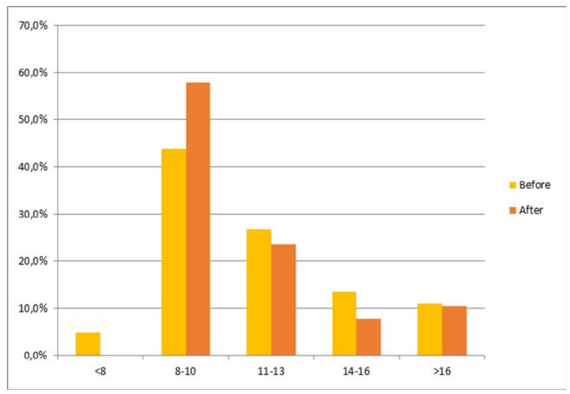

Fig. 3. Length of passwords before and after the information security course

The complexity of passwords is manifested in the diversity of characters used. Nobody have used lowercase only passwords before or after the course, and there was an insignificant number of those who used only lowercase and uppercase letters.

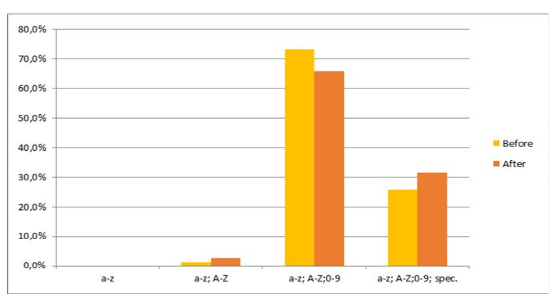

Fig. 4. Character types used in passwords before and after the information security course

We have previously mentioned that a significant part of the service providers already has a complex set of compulsory character types, but we can still find systems that do not have any specifications for passwords.

The number of people using letters and numbers in their passwords decreased at the end of the course (from 73.2% to 65.8%), and the proportion of user's passwords with special characters increased (from 25.6% to 31.6%), this is a very welcomed change (Fig. 4).

Also, with regards to password management a positive change can be seen (Figure 5).

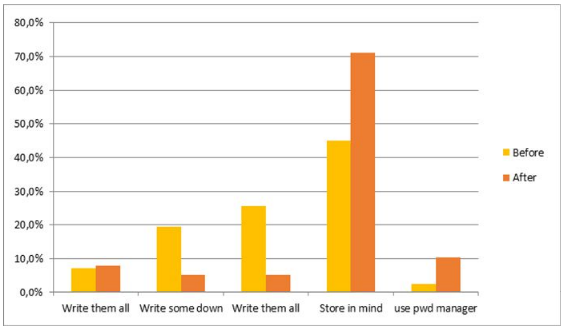

Fig. 5. Password management before and after the information security course

After the course of information security somewhat grew the proportion of those who noted down all their passwords (from 7.3% to 7.9%), but the number of those who note down a part of their passwords or remember them by the browser (from which a malicious code will make it possible for the attacker to remotely access it) was reduced.

B. Mann-Whitney-test

For comparing the password usage patterns before and after the course with statistical tools due to the order of the scores we used the Mann-Whitney test [6].

TABLE VII. THE RESULTS OF MANN-WHITNEY-WILCOXON TEST QUALITY OF THE FRESHMEN STUDENTS BY FACULTY

Password habits	***P***
Difference of password	0,252
Password changing	0,585
Password length	0,535
Character type of password	0,590
Password handling	0,001

The Mann-Whitney test did not show any significant difference between the passwords characteristics of the two periods. However, at the end of the course, there was a significant improvement in password management (Table VII.).

This means that a board-based, PowerPoint based presentation with additional video recordings support, which is a passive perception, did not have a strong impact on students' password usage habits. We have achieved the same results as articles in the media on this subject.

IV. CONCLUSION

In this research we analyzed the Password Habits of the entering mechanical engineering and the safety technology students. Our starting hypothesis was that the safety engineering students would achieve better results in the Password Habit.

After the analyzing process we found out hypothesis was not correct. The choosing of the faculty do not have any influence on the Password Habits of the entering student.

Secondly in our research, we sought to find out how the teaching methodology used in the information security course affects students' password management habits.

Nowadays we can read in many places about the system attackers acquiring our personal data managed by various internet service providers, capturing the encrypted versions of our passwords we use. The decryption time depends mostly on length and complexity of the password we use. The safeness of our data stored in other systems depends on how much different passwords we use for each system.

At the beginning and after the end of the course, the password-specific data given by the mechanical engineering students were scored so that we could perform a statistical analysis. The result of the Mann-Whitney test showed that traditional teaching tools (table, PowerPoint presentations) with occasional video footage that illustrates the time needed to crack different passwords did not prove to be very effective to make students' password usage habits more secure. Only in password storage have been our students significantly more aware, they use a safer solution that only partially protects them better from a targeted attack if the other properties fail to change appropriately. The answer to the question in the title the traditional teaching tools can not change really the information security awareness of the students.

The board, PowerPoint presentations and video recordings are passive perception for students. It is worth to try out the use methods requiring activity by students during information security training, examining the impact on their information security attitudes.

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Examination of Functions in the GeoGebra Program Package

D. D. Nedić
University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Hercegovina
dragana.nedic@sf.ues.rs.ba

Abstract-The paper shows how in a simple and interesting way the function flow in the GeoGebra program package is examined. When examining functions, a computer was used as a teaching tool for displaying images, applets, and interactive illustrations. In general, this approach is very useful in explaining mathematical ideas, abstract concepts and mathematical problems.

I. Introduction

Rapid changes that take place in science, technology and other aspects of life should be accompanied by a teaching process which must overcome lagging and seek new, more efficient and saver solutions. First of all, it is necessary to improve teaching, to introduce new organizational forms using modern teaching tools, to find new and innovative solutions, all with the goal of learning progress.

The use of new teaching technologies is very useful for learning progress.

Multimedia can greatly help to improve the teaching process, but also to encourage students to learn. The same information is better and easier to remember if a visual image is being accompanied by them. Of great importance is the linking of images with certain conditions in order for students to develop additional knowledge [1].

In particular, in mathematics there is a set of mathematical software that can introduce positive changes in mathematics teaching and overcome the limitations of classical teaching. Using mathematical software, in this case, the GeoGebra software, the ability to visualize mathematical content as well as a more creative approach to mathematics education opens [2].

II. Testing the Function flow

In all technical schools, as well as at technical faculties within the mathematics subject, a differential account is studied, as well as its application to the examination of the flow of function.

Examining the flow of a function can be processed by using the GeoGebra software package as a teaching tool, which is suitable for displaying images, applets and interactive illustrations [3].

When examining the flow of function, of course, after the theoretical part that preceded, it moves to the display of applets from which students can further learn. The teacher clearly and systematically exposes the presentations at the same time, activating and encouraging students to draw conclusions themselves and to notice the characteristics of the observed function.

A. Applets in GeoGebra

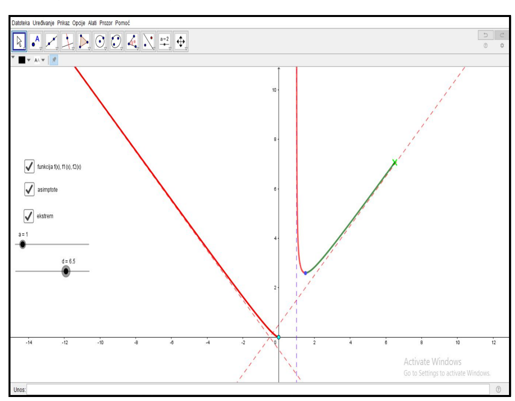
Example 1

For function

$$f(x)=\sqrt{\frac{x^3}{x-a}},\ a>0 \qquad (1)$$

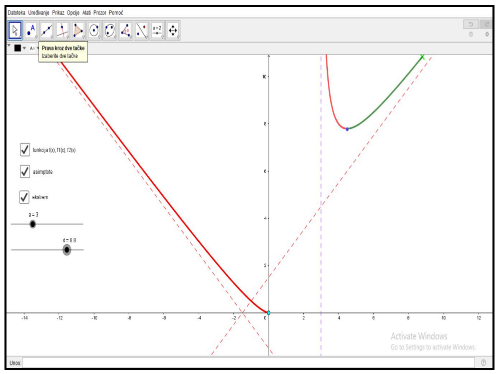
zero, asymptote, extreme value, and monotonic function [4].

With given graphic functions students can clearly see where zero functions are functions, the extreme value of the function, the asymptote, and to read the intervals at which the function grows or decreases, which is clearly indicated by different colors (Picture 1a).



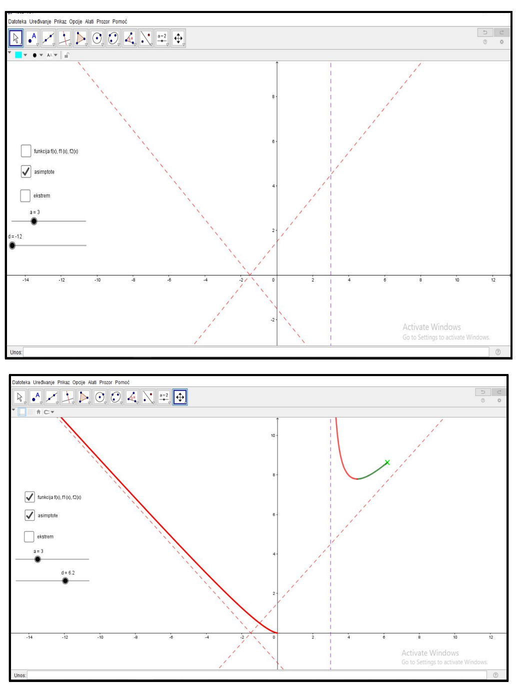
Picture 1a. Graph of function $f(x)=\sqrt{\frac{x^3}{x-a}},\ a=1$

Moving the slider can also change the function, which means that for different parameter values a we can very easily change the function. (Picture 1b.)



Picture 1b. Graph of function $f(x)=\sqrt{\frac{x^3}{x-a}},\ a=3$

Also, GeoGebra allows you to display part of the elements that make up the observed function. (Picture 1c.)



Picture 1c. Asymptote, monotonic function $f(x)=\sqrt{\frac{x^3}{x-a}},\ a=3$

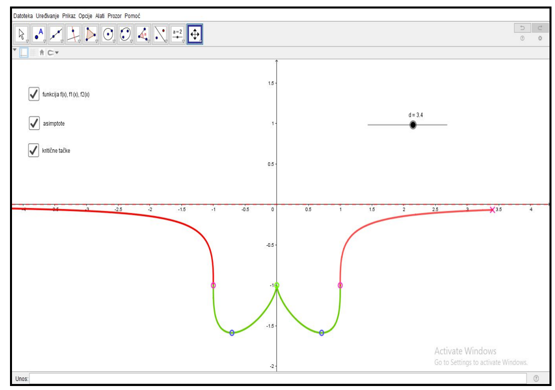
Example 2

For function

$$f(x)=\sqrt[3]{x^2-1}-\sqrt[3]{x^2} \qquad (2)$$

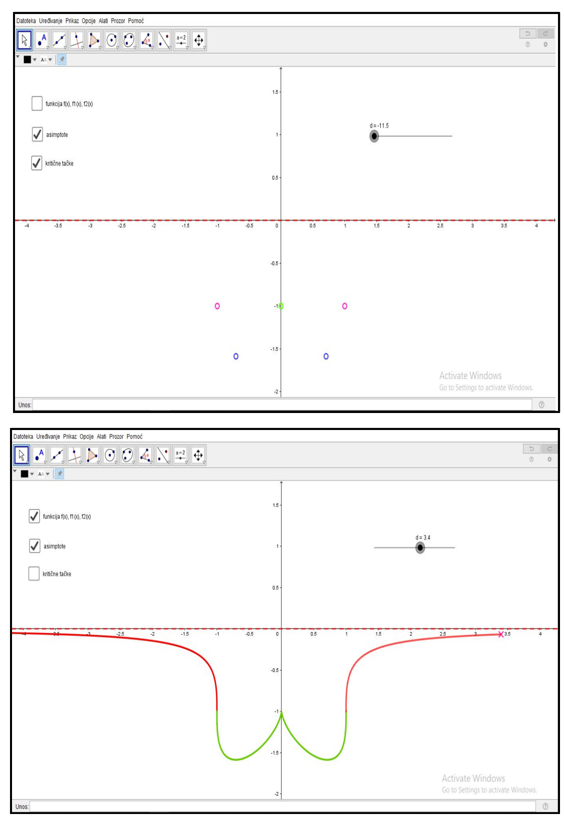
asymptotes, critical points as well as function convexity [4].

By moving the slider d, the graph of the observed function is plotted and the intervals on which the function is convex or concave are clearly shown. (Picture 2a.)



Picture 2a. Graph of function $f(x)=\sqrt[3]{x^2-1}-\sqrt[3]{x^2}$

In the same way as Example 1 it is possible to individually display the corresponding function elements. (Picture 2b.)



Picture 2b. Asymptote, critical point, function convexity $f(x)=\sqrt[3]{x^2-1}-\sqrt[3]{x^2}$

III. Analysis of Work and Evening of Experience

Experience shows that examining the flow of function to students, ie students, especially those with a weaker background, is a problem. It happens that the student enrolls the technical faculty, and that he did not meet with the differential account before. There are problems right now at the start.

It is a question of how to teach these students and to get them interested in the subject in general, in order to achieve certain results.

In such cases, it is very useful to use computers and mathematical software in teaching, or using modern teaching aids.

A. How to process a teaching unit?

Using computers in mathematics teaching, a teacher can use different methods of work, all of which depends on the teacher and his ideas on how to implement the teaching time.

For example, it can first pass the theoretical part to students, then display applets. It is also quite an effective interactive method where the presenting applets introduces certain concepts by letting students to draw conclusions [5].

Often it happens that the student is examining the function, and the problem is to draw up a graphic. In this case, it is very hard to use the computer, because by displaying graphics, by changing the parameters using the slider, which specifically allows GeoGebra, students are instructed to draw conclusions.

Students are active, most of them are engaged in solving the problem. Time does not represent a rough scheme, simply students are free to explore.

If a teacher has a computer room available, the team is more efficient in this type of teaching, because students are able to explore it independently. It should be emphasized that this type of work is not strictly linked to one time in a timely manner. This kind of work from teachers requires a lot of preparation, regardless of the fact that he is only an instructor at this time, if the interactive method of work is decided and planned. Not only must it be very creative, it should do such appliances that will be very interesting to students.

B. Short end on time realization

In order to determine how effective this approach is to be followed, it is advisable for the teacher to test the students before the unit is processed, to determine how much their knowledge is, then immediately after the processing of the teaching unit, to determine how many materials have been adopted and one month after the instruction has been processed it can be seen how much material has been permanently adopted. It is also desirable to assign a homework assignment, where students will research themselves. Studies have shown that this method is effective at the Faculty of Transport. It was done according to the above-mentioned method, and a survey was conducted aimed at determining how many students are interested in this type of work [3]. The results of the tests, but also the surveys, showed that this type of work is quite efficient and successful, and that interactive learning is in the advantage over traditional learning, where the student is mostly in a passive position.

IV. Conclusion

The use of mathematical software in teaching is very useful in the process of creative creation, problem solving, research, active participation in teaching, motivation for work, unlike the traditional approach where the student is mostly in a passive position. This kind of work from teachers requires a creative, meaningful and interesting approach to teaching, while students adapt to new circumstances, and mathematical concepts are built with the help of teachers, but they can also experiment themselves.

The goal of this approach is to encourage the student to encourage learning and progress in mathematics, to increase motivation, to think logically, to gain self-confidence.

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Language Benefits with Skype in the Classroom

T. Dabic*, S. Grkavac **, Ž. Stojanov***, R. Suzić****

* Sinergija Univeristy/Faculty of Philology, Bijeljina, Bosnia and Herzegovina
** Srednja škola/Trebinje, Bosnia and Herzegovina
*** University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Serbia
**** University Singidunum, Belgrade, Serbia
tdabic@sinergija.edu.ba, sgrkavac@yahoo.com, zeljko.stojanov@tfzr.rs, rsuzic@singidunum.ac.rs

Abstract - The paper presents Skype in the Classroom features focusing on the language benefits that can be gain by the use of this tool in the classroom. First, the development of Skype as a tool for communication is given. Afterwards, the emergence as a Skype as a tool in education is elaborated with all its specific features (Virtual Field Trips, Guest Speaker, Mystery Skype, Skype Collaboration). The mix-method research was set to explore the use of the listed features among the teachers and language and non-language benefits. It included 55 participants all around the globe via open-ended questionnaire. The results of the questionnaire proved that many teachers used Skype in the Classroom and all its features and it gave insights into the importance of learning English and other foreign languages via Skype, including its features and benefits. In, the end, the Skype in the Classroom proved to be the excellent tool for improving all language learning skills. Nevertheless, the research proved to have many non-language benefits that are not presented in the paper, as they are do not fit in the scope of the paper.

Key words: Skype in the classroom, online educational tool, features, foreign language learning, benefits

I. Introduction

One of the most important things in human life should be communication, the process of sharing our knowledge and information. We use communication every day in different ways, sometimes we do it by using words, expressions or actions. In some way or another, we constantly have a need for the exchange of our thoughts and ideas. New Digital Era has brought us new means/tools of communications that enable us to talk and see people all over the world free, only if we have the Internet. Many of these tools have grown into educational tools serving many other purposes than their primary one. One of them is Skype [1].

On the *Top Tools for Learning 2018* (www.toptools4learning.com) Skype holds eighteenth place what proves that many educators use it. This corresponds to the growing demand for both teachers and students to be digitally literate and fluent [2]. The state of being both (digitally literate and fluent) frequently implies the use of various educational tools in teaching [1]. As nowadays students belong to the generation of digital natives these tools seem natural to them and they with them they manage learning processes effortlessly and joyfully [3].

The aim of this paper is to show and prove that *Skype*, used as an educational tool, can be highly beneficial for foreign language learning, in this case English.

II. Skype as a communication and educational tool

A. *Skype as a Communucation Tool*

Skype is a voice communication tool that is available almost everywhere in the world. It was invented by Scandinavian enterpreneurs Niklas Zennstrom and Janus Friis. In the beginning, with the help of the Estonian programmers Ahti Heinla, Priit Kasesalu and Jaan Tallinn, a peer to peer file-sharing program Kazaa was launched, but finally on 29 August 2003 the software application Skype was introduced to the world. The project was initially named "Sky peer-to-peer" and morphed into Skyper. Later the final letter *r* was dropped and the title of the original concept has become Skype. Throughout the years there have been several changes to Skype logo and it is now an icon that features the letter S that is white with a blue background. The white colour of the logo represents harmony and peace while the blue colour of the logo represents hope, prosperity and communication.

Figure 1.

The original Skype application 0.9 allowed voice calls from PC to PC and it was followed by several subsequent versions. The best version was released in 2005 and it was called version 2.0. The internet call industry has been revolutionized and the new communication tool has enabled video calls. During all these years there have been lots of changes and improvements: Skype 3.1. was a better version but it was replaced by Skype 5.2. Skype was sold to Microsoft for $8.5 billion in cash in May 2011. And it has become the main Microsoft Messaging service. Nowadays, Skype is the leader for video communication and for online voice calls. It offers a wide range of features that are designed to help you connect when, where, and how it suits you best [4]: a) calling features, b) messaging features, c) video sharing d) file and screen sharing and e) calendar link. All these features have provided the opportunities for Skype to enter other domains besides, its primary one, the communication for personal and business purposes. It entered the domain of education and has changed it immensely.

B. Skype in the Classroom

Education should be inspiring and it should follow new technologies and new styles of learning. Many educators do not realize that Skype could be a valuable classroom asset that gives students lots of new opportunities to learn [5]. *Skype in the Classroom* offers five educational ways of learning: Virtual Field Trips, Guest Speakers, Classroom to classroom connection - Skype live collaboration projects and Mystery Skype [6].

Virtual field trip is a guided exploration through the world wide web that organizes a collection of pre-screened, thematically based web pages into a structured online learning experience [7]. Virtual field trips (VFT) are free and they are excellent for the students who attend Primary or Secondary school to explore new places, meet different cultures and people without leaving the classroom. In order to comprehend better, students should prepare for the lecture, by providing more material about the topic that can be reviewed after the virtual trip. This type of class is always amusing for students and they feel more motivated to learn. If a spark of entertainment and fun is added to the education, kids are more eager to learn and more ambitious [8].

The second feature is the *guest speaker*. Every classroom is sometimes predictable and this new feature is valuable for students in many ways. As it cannot be expected from the teachers to be experts in all fields, it is an excellent opportunity to have a professional in the classroom. These professionals, who talk about a special field of expertise, are called Guest Speakers. Nowadays, there are many Guest Speakers who do multiple sessions during a week giving students an insight into the new world enhancing students' educational experience. Using Skype in the classroom allows guest lecturers/speakers to talk with students from anywhere in the world at any time, eliminating the need for the speaker to physically be in the classroom [9]. Learners of all ages and experience levels are hungry for variety, and seeing a new face in front of the room can liven up the class, but there are also deeper pedagogical reasons for using guest lecturers [10].

The third feature are *Skype Live Collaboration Projects*. Connecting the classrooms the students can see the world from another perspective and meet some unknown cultural and social norms. They can work on projects, share their half via Skype and the other classroom presents the missing half. It allows students to learn and meet people and explore cultures from all over the world. By this feature, students build compassion, share knowledge, have fun and empathy for one another. Classroom to Classroom interactions bring new joy to students and encourage them to actively participate in discussions [9]. Because of this new classroom technology, students have collaborative learning as a new method of learning methodologies. Students mostly work in groups and they are all involved in the project. They have to work together and solve a problem. So they learn to respect each other, hear different opinions and by this method they develop their social skills and learn from their peers at the same time. The collaborative learning methodology is ideal for children that have difficulties in a social setting [11].

The last feature is *Mystery Skype* - the global guessing game. Students can learn about geography, culture, and the similarities and differences of how children live all over the world [12]. It is an educational game with the aim to guess the location of the other classroom. It is played by two classrooms on Skype and it is suitable for all ages. By asking questions, students can learn more about the global community and they can effectively communicate. Usually, they provide clues to each other. The game incorporates communication and critical skills and, at the same time, it develops creativity and collaboration [13].

III. SKYPE IN FOREIGN LANGUAGE TEACHING

Learning a new language can improve students employment prospects in future and set up for success in nearly every aspect of life. The world becomes increasingly globalized and monolingualism stays in the past. Foreign language study is all about learning how to truly communicate and connect with others an incredibly important life skill that can only be cultivated by interacting with people [14].

Nowadays, students are able to learn a foreign language in an exciting way, using new forms of technology and can learn online from any location, where they want and when they want. In the 21st century, online tuition is accessible to everyone who has Skype. Skype offers fully qualified native British teachers that have experience in teaching at all levels; from young children to mature people. Skype offers a variety of programs to all students who want to prepare for a specific English exam.

Skype in the Classroom cherishes intercultural understanding and builds links between classrooms/students all around the world. These links nurture diversity, respect, understanding and they allow discussions on global issues. By connecting classrooms and students from all the continents, at the same time, Skype in the Classroom connects different races, religions, socio-economic classes and cultures as well. Skype in the Classroom helps to bridge the physical divide of oceans and continents by allowing students to connect on a personal level, developing empathy and learning to recognize a person for the character of their heart. At the same time it develops all four language skills in an unconscious but effective way [15].

IV. METHODOLOGY

The main study of this research is to detect the benefits of teaching and learning English via Skype. By combining a quantitative and qualitative element mixed-method research was conducted. Sequential Explanatory Design was employed since the purpose was to use the qualitative results to further explain and interpret the findings from the quantitative phase [16].

The employed instrument was the questionnaire that incorporated both closed and an open-ended questions (See Appendix). The questionnaire included 12 questions and it was designed by the researchers. The data were collected with Google Forms. The quantitative data were analyzed by Google forms, showing frequency, while four open-ended questions were analyzed by creating a coherent narrative, eliciting categories and including quotes provided by the respondents. The online questionnaire was posted into global Facebook group *Skype in the Classroom Enthusiasts.*

The sample included 55 teachers from all over the world. The majority of them is from Germany and Russia, then the United States of America, but there are also teachers from China, Japan, Puerto Rico, Tunisia, Bangladesh, Slovenia, Albania, Bosnia, Montenegro and India. See *Figure 2*.

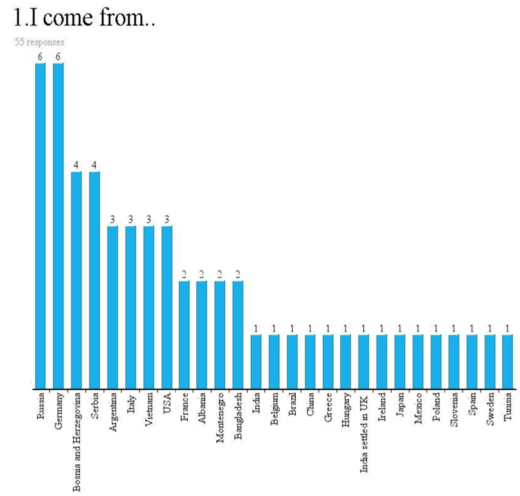

Figure 2. The Sample Country Distribution

The structure of the sample concerning their years is the following: 41.8% are more than 40 years old, 40% of them are between 30 and 40 years old and just 18,2% are between 20 and 30 years old. Among them there are 23 male respondents and 32 female respondents.

Most of them are teachers who teach English, in fact 26 of them or 47,3%, then some of them teach French, Spanish or German, but there are teachers who teach IT, History or work in the Elementary school, too. See *Figure 3*.

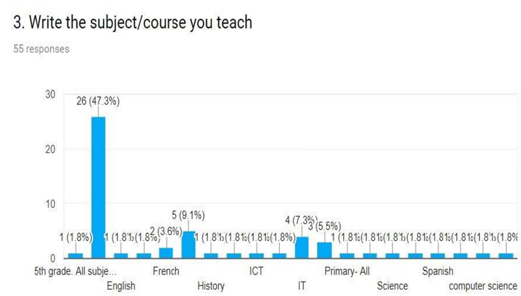

Figure 3. Subject they teach

The great majority of them, or 41,8%, answered that they use Skype in the classroom between two and five years, 27,3% answered that they use it more than a year. Some teachers, or 9,1%, use it for more than five years ,but there is 27,3% who use it less than a year. See *Figure 4*.

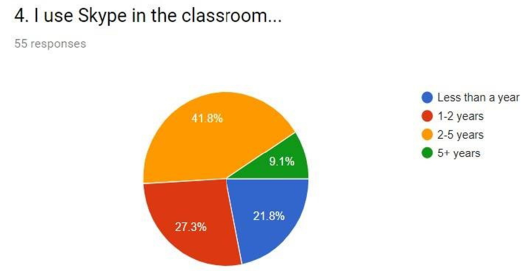

Figure 4. How long they use Skype in the Classroom

The next section deals with the results related to Skype features that can be beneficial for language learning.

V. DISCUSSION AND RESULTS

Although the broad concept of the research includes both language and non-language benefits of learning language via Skype, the paper presents merely results on language benefits: the following questions from the online questionnaire: fifth, sixth, seventh, eighth, ninth and twelfth.. More precisely, how useful Skype in the classroom is, the features the teachers use, the ones they like most and see as the most useful for language learning. Furthermore, to mark the most valuable foreign language benefits with Skype in the Classroom and benefits Skype impose on foreign language learning and to briefly summarize in one or two sentences the Skype in the Classroom experience for students.

Almost 61.8% percent of teachers use all features in their work with students, but we can see that the feature called "Guest Speakers" is used by 16,4 % teachers, "Mystery Skype" by 12.7% of teachers and "Virtual Field trips" by 7.3% of teachers. The feature of Skype in the classroom that the respondents like most: all of them (67.3%), Guest Speakers (16,4%) and Virtual Field trips (9,1%). This confirms that all the features of Skype are used in the classroom and the Skype is a useful fool for learning. The previous statement is also confirmed by the answers to the seventh question. See *Figure 5*.

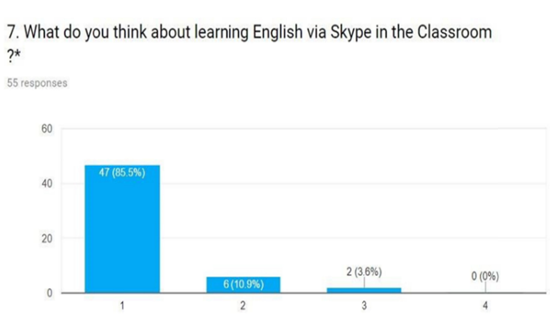

Figure 5. The Usefulness of Skype for English learning

As it can be seen, the majority of respondents (85,5%) perceive Skype in the Classroom very useful for learning English.

When the research participants were asked to mark the most useful feature for language learning, they provided the following answers (See *Figure 6*.)

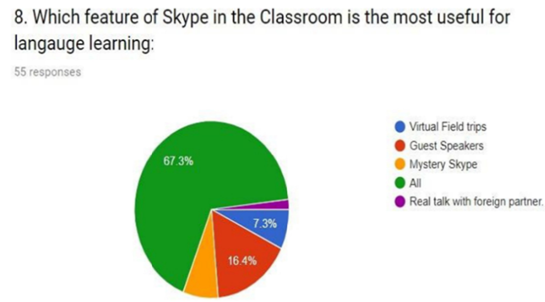

Figure 6. The most useful feature for language learning

The data from the pie chart show us that teachers think that all features are equally important because 67.3 percent of respondents chose the answer – All features. Among the other features, the most prominent is Guest Speaker (16,4%), while the other are less than 10%.

In order to detect the areas within foreign language teaching and learning that can benefit most from Skype in the classroom the researchers asked the respondents to choose 5 the most valuable foreign language benefits with Skype in the Classroom:

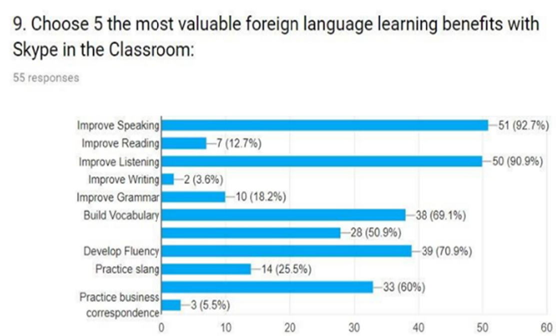

Figure 7. The most valuable Skype features

The bar chart (Figure 7.) shows the most valuable language learning benefits with Skype in the Classroom. The respondents chose "Improve Speaking" (92.7%) as the most valuable language benefit, then "Improve Listening"(90.9%), after that "Develop Fluency" (70.9%), "Build Vocabulary" (69.1%) and finally "Reduce anxiety when speaking a foreign language" (60%).

Teachers know that the most difficult skill to master is speaking practice! Even after learning

English for years and years it is hard to speak with a clear accent and talk at natural speed, using naturally slang and idioms. But when the student learns English online and wants to fluently communicate in English, first he has to improve his/her listening skills. Step by step, the fluency is going to develop and the vocabulary too but it is important to reduce anxiety when speaking a foreign language. It is very practical to reduce it using Skype features and all its benefits and values. The results from the theoretical part matches with the obtained results from this questionnaire.

The last question to be analyzed is also the last question in the questionnaire. The participants were expected to describe in one or two sentences the Skype in the Classroom experience. The answers that were chosen from the transcript, as being relevant for the paper, are:

- *A joyful experience with a lot of benefits.*
- *Amazing, they just love it.*
- *The experience is amazing and students always ask for more..*
- *Skype in the classroom opens up the whole new world for both me and my students.*
- *They have been very much motivated to learn and use the language.*
- *A power tool to engage students.*
- *Exciting moments in students' school life.*
- *Exciting and knowledgeable.*
- *Powerful, engaging and knowledge gaining.*
- *It is great chance to meet students and teachers all over the world and an excellent way to practice English.*
- *It builds global bridge.*

As it can been seen from the participants' answers, with these several sentences it may be concluded that teachers and students really enjoy Skype in the Classroom. The students love it, they are more motivated to learn and use the language. They think that Skype builds global bridges and that it opens up the whole new world both for students and for the teachers.

VI. CONCLUSION

The research has proven many benefits from the Skype in the classroom use: students build their vocabulary, improve speaking and listening practice or practice slang. They have the unique chance to reduce their anxiety by speaking with the native speakers, learning new words and practicing pronunciation. It motivates them to learn more and it is an excellent way to practice English and communicational skills in real world scenarios. Students may become engaged in different projects, learn how to work in groups and how to learn beyond classroom.

We may conclude with this research that the Skype in the Classroom really increase knowledge, it connects people all over the world, breaking down the barriers, raise the cultural awareness and it learns a lot about respect and diversity. The Skype in the classroom should be used in all schools because it opens new opportunities for every student and teacher. It is very important to use this new technology in our classroom because it makes learning more interesting and more enjoyable.

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Appendix 1

Language and Non-language Competences Gained via Skype in the Classroom

With this questionnaire, I want to find out what do you think about Skype in the Classroom! Don't worry, you will remain completely anonymous. I realize how precious your time is, so that's why this survey will only take a quick 45 seconds.
* Mandatory

1. I come from... *(name of the state)

2. I am... * a) 20 - 30 years old b) 30 - 40 years old c) 40+ years old

3. Write the subject/course you teach *

4. I use Skype in the classroom... *
a) Less than a year b) 1-2 years c) 2-5 years d) 5+ years

5. In Skype in the Classroom I have used: *
a) Virtual Field trips b) Guest Speakers c) Mystery Skype d) All

6. The feature of Skype in the Classroom that I like most is: *

a) Virtual Field trips b) Guest Speakers c) Mystery Skype d) All

7. What do you think about learning English via Skype in the Classroom ?* *
Not useful 1 2 3 4 Very useful

8. Which feature of Skype in the Classroom is the most useful for langauge learning: *

a) Virtual Field trips b) Guest Speakers c) Mystery Skype d) All

9. Choose 5 the most valuable foreign language learning benefits with Skype in the Classroom: *
   a) Improve Speaking
   b) Improve Reading
   c) Improve Listening
   d) Improve Writing
   e) Improve Grammar
   f) Build Vocabulary
   g) Develop Communicative Competence
   h) Develop Fluency
   i) Practice slang
   j) Reduce anxiety when speaking a foreign language
   k) Practice business correspondence

10. Choose 5 the most valuable non-langagauge benefits students can gain with Skype in the Classroom: *
   a) Cultural awareness
   b) Tolerance
   c) Sharing photos/videos
   d) Get a glimpse into the everyday life
   e) Global collaboration
   f) New ways of thinking
   g) Less prejudice
   h) Respect
   i) Diversity
   j) Sharing knowledge
   k) Cross-culturally connections
   l) Global issues
   m) Collaborations between students and teachers

11. Choose 3 the most valuable skills that children can develop when using Skype: *
   a) Prepare the questions in advance
   b) Learn how to take notes
   c) How to ask good questions
   d) How to apply critical thinking
   e) Work in groups
   f) Engage in projects
   g) Improve employment prospects
   h) Actively participate in discussions
   i) Share opinions
   j) Set clear goals and objectives
   k) Improve decision-making skills

12. How would you describe in one or two sentences the Skype in the Classroom experience for your students?

The Application of Intelligent Tutoring Systems in Education

G. Jotanović*, V. Brtka **, G. Jauševac*, A. Stjepanović*, M. Stojčić*
* Faculty of Transport and Traffic Engineering, Doboj, Republic of Srpska, Bosnia and Herzegovina
** Technical Faculty „Mihajlo Pupin“, Zrenjanin, Republic of Serbia
gjotanovic@yahoo.com, vbrtka@tfzr.uns.ac.rs, goran@yahoo.com, aco_stjepanovic@yahoo.com,
mirkostojcic1@hotmail.com

Abstract–The paper presents the possibilities and constraints of Intelligent Tutoring System (ITS) implementation in education. The application of ITS in the education system is used to achieve different objectives. The most important goals of ITS implementation are the establishment of quality interaction of students with the system and the formation of curricula based on the principles of modular education. Often, ITS is designed only for certain teaching subjects or teaching domains, which is a constraint on student learning. The implementation of intelligent tutoring systems in education has been viewed through certain content for learning, learning outcomes, user interface, etc.

I. Introduction

Teaching students who differ widely in ability is one of the toughest challenges teachers face. Intelligent tutoring systems (ITS) may help the teacher to overcome it. ITS is a software that are designed to act as tutor, teaching material to individual students working on computers [1]. Also, ITS measure students' relevant skill sets and present them throut personalized problems or exercises.

Through the historical development of intelligent tutoring systems based on web and e-learning, there are systems that allow users to create, organize, control and use learning content and achieve mutual collaboration through computers and communication networks. The first systems for student's education with the help of computers are Computer Aided Instruction (CAI) or Computer Based Instruction (CBI). These systems were usually based on the hypertext, and consisted of the prepared learning content. With the rapid development of the education system, the computer as an instructor evolved into a tutoring system. In this case, intelligent tutoring systems have developed from the Artificial Intelligence (AI) systems. At first time, the goal of ITS was to design the attributes of a tutor in ITS similar to the characteristics of teachers.

Sleeman and Brown [2] use the term Intelligent Tutoring Systems (ITS) for the first time to new edition of CAI systems. ITS had the following tasks: problem solving by the method of monitoring students' knowledge, training, giving laboratory instructions, consulting [2]. The initial forms of ITS had the following disadvantages: the systems were domain-dependent, poorly assessed students' knowledge; the documentation had a small level of detail, poor student interaction with the system, system's inflexibility [2, 3, 4, 5].

II. Intelligent Tutoring System

Different intelligent tutoring systems have the same task of adapting teaching methods to the student using an intelligent component. Adaptation means that the system itself is able to adapt to the different needs of students. The system decides on how a student should learn; perform a complex assessment of students' knowledge, skills and abilities. A mediator between a system and a student is a Student module. On the basis of these functions we can conclude that the module is obligatory for the construction of ITS. The domain module is also important because it represents a domain of knowledge. A well-designed domain module will help the system select the appropriate teaching method, which includes the selection of alternative teaching methods when a particular teaching method does not work. The most important part of the ITS is the "interference engine". It is the "brain" of the whole system which communicate with all the modules within the ITS. The expert knowledge base is located within the domain module, and is built by specialists in the field of study. Errors in the forming of the knowledge base ITS also entail errors in the rules for generating a teaching strategy.

*A. Intelligent tutoring system **InterMediActor***

InterMediActor the ITS that uses fuzzy logic inference mechanism [6]. The system is based on a structure called the navigation graph. The structure determines which concept comes after "making" a decision. Decisions are made for multiple choices using fuzzy logic rules. Fuzzy rules includes the student's abilities and teaching concepts. Decision-making mechanism makes a decision based on whether the concept is suitable for a student or not. Student characteristics and other necessary information about the student as well as the teaching concept are described in the system as a fuzzy logical sets. Fuzzy logic rules determine the relationships between the fuzzy logical sets. The rules are based on the observation of three parameters. The first parameter is the severity of the topic, it can have the values „simple“, „normal“ and „difficult“. The values of these variables are dynamic. For example, if the student from task has achieved high grades, the degree of difficulty will be reduced and in the case of low, the degree of difficulty would increase. The second parameter that is observed in the system is the result in the final test. This variable have values "positive", "negative" or "undefined". The third parameter relates to previously acquired knowledge of a student. Its values may be insufficient, a „good“, „good enough“, and „very good“. The fuzzy rules include the values of the parameters in order to determine whether the concept was appropriate for the student or not. The consequent value of the variable called Level-recommendations can have values such as: Learn, more learning is recommended, it is recommended that you learn more, it is recommended that you learn a bit and learn enough. Using the navigation graph are presented all learning concept and their dependencies. The system is based on IF ... AND ... THEN rules [7].

*B. Intelligent tutoring system **Andes***

Andes is an ITS for the education of physics teaching students at the Maritime Academy [8]. This system works on the principle of Bayes networks. The basic tasks of the system are to select the most appropriate learning strategy for a student, envisage student actions, and perform long-term student assessment from a learning domain.

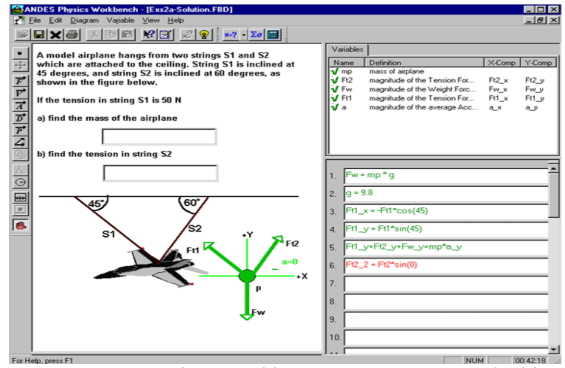

Figure 1. Solving problems in ANDES using a double choice axis of aircraft [9].

The knowledge base of ITS Andes solves problems in physics, exclusively the hard troubles for the Naval Academy students. Figure 1, knowledge base consists of 600 rules, divided into two groups: targeted rules and rules of physics knowledge. The targeted rules are used to guiding the students through system steps to the exact solution of the problem and the rules of physics knowledge are used to provide basic concepts from the learning domain of physics [9]. In this way, each problem in the system is decomposed into several steps presented by the Bayes network; the steps are replaced by the nodes of the network. The Bayes Network predicts the most likely path for the student trought the courseware. Usually each student has different approaches to the problem, the network should therefore to adapt to a given problem and predict the best strategy for students in solving new problems. This option is named in the Adnes system a *problem-solver*. It partially or completely solves the problem of student learning assistance. The formed Bayes network consists of two parts: static and dynamic. The static part is based on the Rule rules of nodes and Context-rule nodes. The rule node represents general physics rules and has binary values, T and F. The probability P (*Rule* = T) is the probability that a student can apply the rule in an appropriate manner in each situation. The dynamic part contains *Context-rule* node, as well as four nodes: *Fact, Goal, Rule-application* and *Strategy-nodes*. *Fact* nodes are binary. P (*Fact* = T) the probability that a student knew the facts and P (*Goal* = T) is the probability that the student has achieved the goal. If there are more than one way to achieve a *Goal* or *Fact* node, in that case the nodes will have many parent nodes. Conditional probability P (*Fact* = T | $parent_i$) assumes the likelihood of achieving the fact of the parent. *Strategy-nodes* are used in cases of multiple choices. *Rule-application* presents different applications in the strategy of nodes. Strategies are mutually exclusive, which means that students can only choose one strategy. *Rule-application* nodes are the connection between *Context-rule*, *Strategy-nodes*, *Goal* and *Fact* nodes as well as new versions *Fact* and *Goal* nodes. The system functions on the basis of probability values varying from student to student, which allow for appropriate choice of rules or alternative routes for each student separately [10].

*C. Intelligent tutoring system **VisMod***

ViSMod is an ITS that also uses Bayes Networks [11]. In this system, the Bayes network is divided into three levels. At the top of ViSMod system level, there are learning concepts. ITS is based on a hierarchical principle. On the second level students' performance and behavior are represented. The third level is the nodes for analyzing student work. Only the first level depends on the learnig domain, while the other two levels can be from different learning domains.

The student's characteristics are monitored only on the first two levels of the Bayes network. The third level was made for the teacher. During the course the student attains probability values at the second and third level of the network, they change depending on the achievement of the student. The probability values at the first level are directly dependent on the probability value of the next two levels. After the obtained values of probability calculated the most likely time for the first level that is determined by the first node. .The Bayes Network was initially formed by teachers using textbooks written for the courseware. The probabilities are formed according to the weight of the courseware. Learning *concept* had to be classified according to three categories: initial level, middle level and expert level. The probability varied according to this categorization. Bayes networks were built using a variety of notions of different weights. Suppose the *Concept* has two parents, which means that parents have some influence on their children, in other words the parent's knowledge increases the likelihood of children's knowledge. System limit values are determined by learning domain experts. ViSMod system there is a parameter called the *weight* that determines the degree of parent's influence on the child. *Weightes* are calculated in the system in the following way: by subtracting the values of parameters between the parents and the child from the boundary values, and then dividing the obtained values with the number of parents the child has acquired. Each node in a network have two values, knows and does not know. If one of the parents of the concept was not familiar to a student then the *weight* of the concept is equal to 0. Parents have equal values of probabilistic probabilities then the choice is left to the expert for consideration. The purpose of the Bayes network was to observe nodes as concepts and edges as their dependencies. The whole ITS works on the explained concept [10].

*D. Intelligent tutoring system **SQL-Tutor***

SQL-Tutor is an ITS for learning SQL language, as the name suggests that. [12, 13]. The system works on principles of the Artificial Neural Network. (ANN). SQL-Tutor used in the ANN for decision-making. The agent in the SQL-Tutor system performs the role of student kompetencies analysis and on the basis of this selects the corresponding problem from the database and modeling is done using neural networks. The reference ITS has a purpose to teach students SQL language. Solutions to problems are presented in the SQL-Tutor system as student constraints. Any solution that the student delivers to the system is compared with the number of restrictions a student violates when solving a problem. The next problem will be chosen based on how many mistakes a student has committed or how many restrictions he has violated when solving the previous problem, Figure 2.

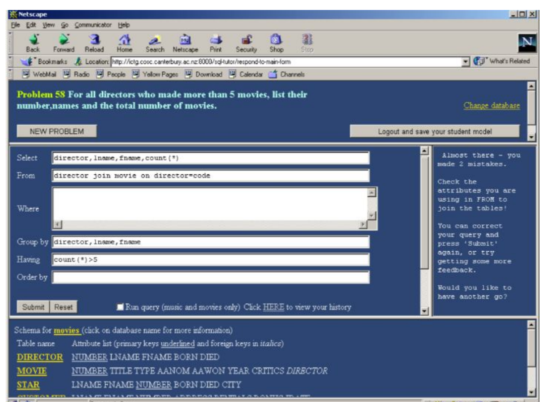

Figure 2.Web-enabled version of SQL-Tutor [13].

Prediction in the system is also performed via a neural network (ANN). The ANN consists of four entrances, one exit and a hidden layer. The SQL-Tutor system has a next inputs: the time required to solve the problem, the level of assistance provided to the student, the level of complexity of the problem, the level of the student's pre-knowledge. One of the ANN inputs attempts to predict the number of errors and limitations the student has committed. This prediction is used to make decisions about the next steps that the system needs to take. Wang and Mitrovic [12] argue can predict the exact number of errors in work of ITS based on system performance, with a precision of 98.06%. An additional advantage of this system is that it provides feedback to the student after checking his problem solution. Feedback may include indications, partial solution, or a complete solution to a student's problem.

E. *Intelligent tutoring system **C++Tutor***

C ++ Tutor is an ITS projects like a rule-based system [14]. The rules were in the form of Horn's clause. Problems are presented to students in the form of a vector. An algorithm called NEITHER would record marked vectors (a student's solution) as an input and transform it into a database, so that modified rules would imply solutions for the student, not the right solution for the system. This process called *Theory-revision*. Thus, the modified rules form the basis of the state of the student's understanding and representing the student with all his knowledge and delusions. After the audit has been carried out, the system attempts to explain the mistakes in the student's concept by showing, for example, the areas where the student made mistakes. This operation is done automatically by the system.

F. *Intelligent tutoring system **Cognitive Tutor***

Cognitive Tutor is an ITS based on Adaptive Control of Thought (ACT-R) a cognitive learning model designed to encourage the student to independently think [15]. In the original versions of Carnegie Learning, the system acted as an expert and applied in a mixed learning and teaching system. The system is intended exclusively for learning and solving problems in the field of mathematics. The user environment of the system is shown in Figure 3.

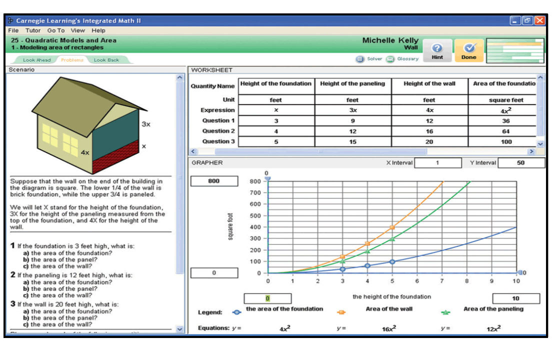

Figure 3. *Solving the surface problem of a rectangular model using the Cognitive Tutor [16].*

The system works by teaching content divided into lessons intended for student training. For each lesson, the system offers a test for checking what the student learned in a particular lesson. If a student possesses sufficient knowledge from a particular lesson, it can be tested even before the training. After the completion of the test, the system points to potential student errors and gives the reason for it. Using the theory of "tracing" the student's knowledge, determines to what extent a student has knowledge in the learning domain. The system monitors how the student solves the problems and, based on the comparison of steps in the work of the student and the system, concludes the correctness of the student's approach to solving the problem. In case when the system can not recognize one of the paths in solving the problem, it is compared with the usual paths.

III. DISCUSSION ABOUT DEVELOPMENT PATH OF ITS IN EDUTATION SYSTEMS

Intelligent tutorial systems in education evolve at a high speed, so a large number of papers and publications in this field have been published.To day, dominate papers based on E-learning and Web-learning, as well as the developments of their tools. Summary of significant tutoring system in education from the early period of development:

Carbonel with the Scholar system that uses a tutorial dialogue strategy aimed at teaching students about the geography of South America, and knowledge is demonstrated by the use of semantic networks [17].

Brown and Burton et al [18] developed the WEST system “How the West Was Won” as a computer game for training in basic arithmetic operations.

Brown, Burton and Larkin develop ITS *Buggy* that can accurately determine the student's errors in tasks with basic arithmetic operations and explain the reasons for the student's mistakes [19].

In the field of intelligent tutoring system in education published several works from the neighboring countries [20, 21, 22]. Some of the papers are based on the implementation of already existing ITS and some on the modeling of new ones such as the Tutor Expert System (TEx-Sys) and EduSof [20, 22, 23]. Jerinic develops an intelligent shell called EduSof. The main goal of this system was the construction of learnig lessons. Process creates the teaching contentes which helps the teacher in edcation system [23, 24].

Stankov developed the TutorExpert System (TEx-Sys) system, from the existing systems, Tutor and SQL Tutor. Cognitive Tutor is being developed as an upgrade of the TEx-Sys system [25].

Kavcic develops a Student model in the InterMediActor environment. This ITS works on the fuzzy logical principles [26].

More recently, papers dealing with intelligent tutorial systems in education are based on the principles of Bayes and neural networks and fuzzy logic systems [27, 28, 28, 26, 30, 31, 32, 33].

Intelligent tutoring system has a many advantages in the application, but there are certain limits in the operation of the system. Systems was in the past and today, largely dependent on the learning domain that has to be precisely defined. Often ITS designed only for specific teaching subjects or teaching areas. One of the constraints of the system is a poor assessment of students' knowledge. In modern ITS, a lot of that has been done on the interaction of students with the system. The interaction takes place through electronic devices such as gloves, glasses, joysticks, control panels, etc. The weakness of the system is the inability to adapt to new circumstances and environments.

IV. CONCLUSION

Intelligent tutorial systems try to take over on the full role of "living" teachers, which is an additional motivation to researchers for various researches in this field. ITS in the education system used for achieve different goals. Contemporary ITS systems encourage the formation of curricula based on the modular principle.

The mentioned method of education enables the personalization of the teaching process as well as individual presentations and evaluations of learning content.

The mentioned method of education enables the personalization of the teaching process as well as individual presentations and evaluations of learning content. ITS systems encourage the collection of database that teachers can use within the teaching system for the correction of student mistakes.

In addition to the advanced functions work of ITS, there are certain drawbacks in the work system. ITS is dependent on learning domains, not adequate assessment of students' knowledge, poor interaction of students with the system, etc.

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Challenges and Development of an ePortfolio Platform and Comparison with Existing Solutions

A. S. Cvetković*, S. Jokić*, S. Adamović*, D. Milanov**
*Sinergija University, Faculty of Computing and Informatics, Bijeljina, Bosnia and Herzegovina
**University of Novi Sad, Technical Faculty „Mihajlo Pupin“, Zrenjanin, Republic of Serbia
ascvetkovic@sinergija.edu.ba

Abstract - The goal of every university is to provide students with the highest quality of education and acquired knowledge; additionally, the goal of universities is to help students in their professional career development. So far, it has been sufficient for universities to organize internships for students, where after students would have the opportunity to be employed; however, new technologies have completely altered ways of doing business, and nowadays it is expected that students have already acquired theoretical knowledge and had practical experience before applying for an internship or their first job in order to face global competition. ePortfolio platforms have proven to be an excellent solution to the changes needed in today's higher education. An ePortfolio encourages students to engage in career development by providing opportunities to demonstrate abilities, discipline, knowledge and work activities during their education to employers. It also allows students to recognize their strong and weak points and ways of improving their knowledge. In this paper, a detailed comparative analysis of an ePortfolio platform has been done, and the current state, advantages and disadvantages, the possible application and the reason why the ePortfolio platform stands out from other available platforms is presented. Further on, it is described what possibilities there are for further improvement and development trends for ePortfolio. Depending on context, the focus of ePortfolio can be on learning and skills, achievements or future goals.

Keywords - ePortfolio, higher education, educational technology evaluation, comparison of ePortfolio platforms, teacher education, electronic portfolio.

I. INTRODUCTION

The primary goal of every university is to prepare students in a particular faculty and profession for the global labor market. For this reason, university curricula must follow all trends in the business world. However, due to constant and rapid changes in both technology and labor market needs, traditional learning methods are no longer as effective as they used to be. Methods based on working through work have proven to be more useful with regard to labor market needs. ePortfolio presents a solution to the changes required in higher education precisely because it allows the application of methods of learning through work. A research has shown that high school graduates must go through a period of adaptation and this occurs during the first year of studies. First-year students are at risk of dropping out of college in the course of or before the end of their first year of academic studies if they do not successfully go through the adaptation period. Therefore, the students' adaptation period is of crucial importance. In this situation, ePortfolio serves as a bridge linking teaching staff, the purpose and goals of students (sense of belonging) and motivation [1]. Such an approach allows students to have clearly set goals in the first year of their studies and start their career development with the full support of teaching staff and university resources.

Learning through work involves more practical and project work, participation in student clubs, and even work on concrete projects according to market demands. It also includes doing internships in companies that students take in the course of their studies, continuous work and activity of all students. This innovative approach introduces individual standards for each student, helps them clear their doubts as well as concerns in case they have had some negative assessments, encourages students to take part in education, with an emphasis on self-awareness, self-understanding, and metacognitive way of thinking through which students reflect on their development, that is, at any moment they can see what they have achieved and the importance of their learning [2].

ePortfolio helps students develop their digital competencies, demonstrate their ability to perform complex tasks and provide evidence-based practice. It enables teaching staff to assess and evaluate students, providing appropriate feedback on the basis of which students can be properly guided to implement their learning, provides an opportunity for students to be assessed using a methodology of learning through work that will give students a realistic assessment depending on the level of competence they have reached. Competencies represent the basic knowledge, skills and attitudes that are essential in any profession or occupation. Work-based learning is closely related to the preparation of students for the labor market. Nowdays employers want to hire candidates having not just the relevant practical and theoretical knowledge, but also the necessary competencies so that they would be successful at their workplace. Students are expected to have adequate background knowledge before they begin to work.

The chief advantage of an ePortfolio is that it encourages students to start thinking about their career development at the right time. It helps to encourage their giving consideration to both the work they do and the way that work is done while working. A student ePortfolio showcases personal competencies, strengths, challenges, learning process, strategies, personal and professional identities, as well as the student's career orientation. However, the process of building a student ePortfolio is not always easy for students, given that not all students are introspective. The role of the teaching staff is to provide the necessary support for their thinking so that students can develop these skills.

II. THE DEVELOPEMENT AND CHALLENGES OF AN EPORTFOLIO PLATFORM

In this paper, the term ePortfolio refers to a pedagogical concept that can be realized using a software solution called ePortfolio platform. An ePortfolio platform is much more than just a software solution because it includes the key components of learning through work.

The key components of learning through work include the following:

- identifying what should be learnt;
- creating your own learning path;
- getting access to various resources, including texts, support from experts and to materials from other students who are also going through the same learning process;
- creating projects and writing papers to identify and contribute to learning; giving consideration to the purport and learning process that leads to further learning [3].

An essential step for the development of an ePortfolio platform is that the platform contains the aforementioned key components of learning through work. The next step is to determine the primary goal of the ePortfolio platform. This goal can be easily defined on the basis of the following questions:

- What are the main ideas?
- What are the main features?
- The application of ePortfolio?
- Who are the participants?

In the process of development, every ePortfolio platform should group the following participants:

- students;
- teaching staff;
- institution;
- IT department;
- alumni, career development services and employers [4].

Answers to other questions vary from platform to platform.

The goals of introducing an ePortfolio can be different, but it is important that the primary focus remains on the learning process of students. Improving teaching, monitoring and supporting students are the relevant goals each ePortfolio needs to have. The next step is to determine the type of ePortfolio platform.

There are four main types of ePortfolio platforms:

- a showcase ePortfolio;
- a learning ePortfolio;
- an evaluation ePortfolio;
- a professional development ePortfolio.

There is also a hybrid ePortfolio comprising two or more of the above mentioned types.

A showcase ePortfolio presents a collection of all the best projects of a student in order to demonstrate their abilities. This type of ePortfolio focuses on the product and the result. Students attach only their best projects and papers with concise documentation on their profiles.

A learning ePortfolio is a collection of projects and students' activities through the process of improving in a given period. This type of ePortfolio focuses on the process rather than the product and result. In the course of academic education, students attach projects and papers they have created within curriculum, not restricting themselves to attaching their best papers only. The advantage of this type is that it allows students to establish links between course materials they have learnt in different subjects.

An evaluation ePortfolio is similar to a showcase ePortfolio. The difference is that an evaluation ePortfolio contains a targeted and summarized evaluation based on a particular subject material. This kind of ePortfolio represents a set of tasks on the basis of which the professor can do an evaluation. Students therefore need to show they have gained the expected competencies through completed tasks. Although it serves as an excellent source of information and enables assessing the level of student competence, this type of ePortfolio is often not sufficient alone, and must be used in combination with other assessment and evaluation procedures [5].

Once the key components of learning through work, specific goals and type of ePortfolio platform are considered, as the last step, it is necessary to determine the technology by which the platform will be created.

The final step involves three options depending on the previous steps:

- developing your own software solution with all modules made from scratch;
- developing your own software solution in combination with ready-made modules;
- use of some of ready-to-use software solutions.

An ePortfolio platform is a repository management system used to create student ePortfolio profiles, store ePortfolio material, and to evaluate on the basis of ePortfolio data with regard to educational needs. A student ePortfolio profile includes academic papers, essays, projects as well as project reports, assignments, audio and video files, and any materials regarding personal and professional development related to learning objectives. All these materials are called artifacts.

The choice of technology by which an ePortfolio platform is to be created is not an easy task, since it includes all the previous steps and it is a complex development. Apart from all the steps, the choice of technology also depends on possibilities and the situation the institution that is to start the development of an ePortfolio platform is in.

If the development time is not a key factor, and if the institution has a large IT department then the best option is to develop one's own software solution from scratch. Various universities have developed their own ePortfolio platforms. Each institution has its own idea of how its ePortfolio platform should look and what institution-related features it should have. Such development allows tailored made software, it can always be upgraded and serves as a lasting solution. The only weakness is the development time of the platform.

In a situation where development time plays a big part after all, and it is planned that the platform should be upgradable, then the best solution is to develop one's own software solution in combination with ready-made modules if required. The development of a platform can take place according to the requirements of the institution, while meeting the deadlines for developing and providing room for upgrading in the near future. This development does not require a large IT department, there are deadlines for development that must be respected, involving frequent use of CMS (Content Management System). This type of development is most commonly used because an ePortfolio platform can be developed within a short space of time, containing all the elements according to the requirements of the institution and is upgradable. The use of CMS contributes to the rapid development of the platform because it offers various modules that do not need to be re-made, but it also sets certain limitations when the ePortfolio platform is upgraded. The way in which certain upgraded modules will function will not be completely identical to the requirements. There will be minor deviations that may be negligible. WordPress is the most popular CMS that offers many different file extensions for the development of an ePortfolio platform.

An ePortfolio platform can be open source such as the Moodle plug-in the Exabis ePortfolio Block. Moodle is the most popular LMS (Learning Management System) open source platform intended primarily for learning [6]. However, an ePortfolio is not just LMS, which is why Moodle has many plugins that can help with creating other elements of an ePortfolio platform. In addition to Moodle platform, there is also Mahara, which is a full-featured open-source platform for ePortfolio building. It contains all the elements that a modern ePortfolio needs to have.

Portfolium is an all-in-one free platform that offers a variety of opportunities for students, educational institutions and employers. The platform enables the creation of portable ePortfolio profiles, offering students and alumni users unlimited storage space so that the Portfolio platform can still be used as a professional profile. It also offers LMS integration and all the other ePortfolio elements. It represents a robust ePortfolio platform that meets many of the demands of an effective ePortfolio.

In addition to free software solutions, there are also commercial ones such as Cengage Pathbrite platform. Pathbrite allows users to build their ePortfolios using various tools with visual experience. It has features such as LMS, provides reports, outcomes and effective insights. The platform offers guidance to students, teaching staff, and employers so that they can get the most out of their ePortfolio profile.

If an institution wants to implement a complete ePortfolio platform in a short period of time and the possibility of upgrading is not of great importance, then the best option is to use one of ready-to-use software solutions. Institutions that opt for this type of software implementation normally want to have a stable and tested environment.

III. COMPARISON OF AN EPORTFOLIO PLATFORM WITH OTHER AVAILABLE SOLUTIONS

The research conducted in 2006 by the FuturEd Incorporation [7] showed that even back then ePortfolio had the most widespread use in:

- elementary and secondary schools as a tool for learning demonstration;
- higher education for assessment;
- lifelong learning**;**
- workspace for recognizing work experience, business training and career advancement;
- LMS (Learning Management Systems) and KM (Knowledge Management) online learning tools;
- organizational and economic development.

The FuturEd Incorporation has been studying ePortfolio since 1997. and its research has shown that the development of ePortfolio will mostly be related to:

- human resources developement;
- lifelong learning process;
- assessing prior knowledge;
- education and training at all levels;
- eLearning;
- learning organizations;
- future learning systems;
- cultural archives through digital narrative.

In the same year, the authors [8] introduced the development of a pedagogical model for ePortfolio that includes PDP (Personal Development Planning). ePortfolio within work is defined as an electronic tool that supports the development of personal planning, including electronic archives, testing capabilities, interactive learning and presentation of results such as CV (Curriculum Vitae). In that period of time, ePortfolio was being researched internationally, with many institutions in the US beginning to develop ePortfolio with the aim of having students be able to document their knowledge and present their achievements.

In 2007, the authors [9] conducted a research comparing the most up-to-date ePortfolios platform on the basis of which it was concluded that apart from being used as an assessment tool, there were various other advantages that an ePortfolio could offer. The authors point out showcasing student progress, development incentive and motivation needed for learning, as well as the fact that an ePortfolio platform can be used for managing courses or as a decision-making process. They point out that, depending on the needs, certain characteristics are more important than others.

The author [10] shows a different approach to the development and student assessment. There is a platform called Netfolio which is based on a different concept than the one ePortfolio is based on. As its name suggests, Netfolio represents a network made up of several student ePortfolio platforms. In addition, Netfolio is much more than just a group of linked ePortfolios because it provides a better understanding of the learning objectives and promotes an appraisal of a student’s existing work, that is to say his ePortfolio, by other students. Their being connected to a larger network consisting of a large number of ePortfolios represent a large system wherein peers can evaluate and assess at the same time. It is considered that such a process contributes more to student progress than when students build their profiles separately.

In 2011, [11] a research on Mahara ePortfolio, which is nowdays still in widespread use, was conducted. The authors carried out the research so as to test the tool and with a view to implementing it more thoroughly at the campus if it proved to be a good tool. Based on this research the results of the second phase are presented in the paper. The results were very successful, given that 88.8% of the participants successfully registered and used the system. The authors also state that, compared to the first semester of the last academic year, better results were achieved in tests with the same types of questions, which indicates that the students were comfortable with using Mahara platform ePortfolio and that it contributed to their making progress.

One case study [12] from 2012 shows that students who attended the MSPM (Master of Science in Project Management) participated in testing the creation of an ePortfolio profile. The students were divided into online students and traditional students with the aim of making an assessment as to which group of students would build a quality ePortfolio. The case study shows that online students built better quality ePortfolio profiles than traditional students; both groups worked on their projects on equal terms, but online students approached their task muchcmore thoroughly.

In 2013, the authors [13] conducted a study on the impact of ePortfolio on the attitude towards learning, academic success and the use of information technologies. A case study was conducted where students from two high schools Tekirdag Technical and Industrial Vocational High School were divided into two groups. ePortfolio was used to support learning and education in the test group attending vocational courses while the traditional approach to learning and education was used in the control group. On the basis of testing, the results of the test and the control group were obtained prior to and after testing. The authors applied the Kolmogorov-Smirnov normality test on the basis of which a significant difference was noticed. The test group students performed much better than the control group students prior to and after testing. Based on this research, the authors came to the conclusion that introducing ePortfolio into education would definitely have a positive impact on student success.

The same conclusion was reached by the authors [14] after carrying out a research at several different campuses in 2014, with regard to the differences that the implementation of ePortfolio could make in education. The authors give three suggestions as to how ePortfolio initiative can improve student success, how to make student learning process transparent and it can bring about a substantial change in the institution. The paper shows a poll carried out on students that is indicative of the students' contentment. When students were asked if ePortfolio had helped them comprehend the course material, 79.8% of them said it had while only 29.5% said it had not. When asked if ePortfolio had prompted them to start thinking about their development through education, 85.4% of students said it had, 30.6% said it had not. When they were inquired whether the creation of an ePortfolio had helped them find the connections between ideas, 86.6% of them said it had, while 30.6% said it had not. As far back as 2014, the authors pointed out that ePortfolio had the potential to play a key role in assessment and evaluation in higher education.

The authors [15] carried out a research and implemented ePortfolio into three courses of study: Fine art, Writing and Housing Design. Over the last ten years, there has been a greater use of ePortfolio in both undergraduate and postgraduate studies. However, the use of ePortfolio in continuing higher education has never been sufficiently explored. The majority of continuing education students, at least when it comes to those course studies where the traditional portfolio is used, are well-disposed to introducing and using an ePortfolio.

The authors [16] described the difference between traditional learning and the ways in which ePortfolio can be used for assessment. Traditional assessment method makes use of multiple testing throughout a semester or a school year, but the test results have not proved to be the best and the most accurate ones since they do not give an objective picture of student results. On the other hand, the main focus is on student learning through work; such process requires different assessment methods that take into account factors such as understanding students and their different approaches to learning. One of the ways of doing such assessment is the use of ePortfolio to assess the students' performance in a subject or to assess how the best quality of learning can be achieved. An example of a specific learning is called self-regulated learning where a student is considered to have achieved success if they meet all the requirements. This process initially defines setting goals and organizing an environment that is essential for learning in order for students to achieve their goals.

In 2018, the authors [17] introduced a new approach to the use of ePortfolio that focuses on positioning students for employers. It is estimated that more than half of educational institutions in North America use ePortfolio, while one-third of educational institutions are planning to implement one. Students of the MPH (Professional Master of Public Health) study programme at Queen's University were tested with the implementation of ePortfolio, using the already available LMS tool of Queen's University. The primary focus was on researching the efficiency of using ePortfolio tools for fostering, demonstrating and promoting key competencies for employers. The results of a survey carried out after testing show that most students are well-disposed to the advantages that an ePortfolio provides. However, the ePortfolio tool used for research was LMS, which had a negative impact on student feedback. More than 70% of students considered LMS was not user-friendly and had no modern design. Only 18% of students were content and felt optimistic about presenting their results to employers.

IV. CONCLUSION

Each educational institution should implement ePortfolio because it provides various advantages in the education system and has the most widespread application in educational institutions. The choice of technology to develop or implement an ePortfolio platform is important because old technology could not do what modern technology can. Modern technology is now headed for IoT (Internet of Things), which means it tends towards centralized and connected systems. The development of IoT made it possible that rather than using three different applications, nowdays we can use just one to perform all the functions.

An ePortfolio platform is not LMS, it represents only one of the modules of this platform. Today's modern ePortfolio platform is not one module but more connected modules that make up an ePortfolio. The development of ePortfolio is going in that very direction, where there will always be a need for upgrading and expanding the modules in order to keep all data grouped and accessible in one place. The development of one's own platform has a small advantage over ready-to-use solutions. If an institution starts to use one of the ready-to-use software solutions for ePortfolio that turns out not to invest in the development and expansion of new modules, nor to be flexible, nor to have the possibility of creating new modules, it can cause a problem because the institution is reliant on that particular software solution. However, if the institution has developed its own software solution, there is always the possibility of upgrading or improving its ePortfolio platform.

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Enhanced Learning with Interactive EBooks

M. Bakator, D. Radosav
University of Novi Sad, Technical Faculty “Mihajlo Pupin“ Zrenjanin, Republic of Serbia
mihalj.bakator@uns.ac.rs, radosav@tfzr.uns.ac.rs

Abstract – Interactive eBooks are slowly finding their spot in the current educational system. Interactivity integrated into learning materials can have positive effects on learning performance. Now, beside the advantages of interactive eBooks, there is the possibility for negative side-effects. Namely, the use of interactive eBooks in schools seems simple and effective. However, the questions is: How is interactivity affecting students in the long-term? In this paper the application of interactive eBooks in education is analyzed. In addition, the importance and future of interactive eBooks is discussed. The main goal is to create a strong basis for future research in this domain. This current paper provides a solid overview of how interactivity in learning, or more precisely, interactive eBooks are enhancing and overall affecting education of students in a formal and informal way.

I. INTRODUCTION

Interactive eBooks can be defined as electronic books which are developed in way that offer tools and options for readers to engage them from one page to the next page. The engagement can be in the form of audio, video, touch screens, highlighted text, animations and other. The main purpose of interactive eBooks is to engage the reader both mentally and physically and to improve the learning experience [1]. There is significant initiative in the domain of interactive learning. For example, initiatives and online trends such as *Massive Open Online Courses (MOOCSs)*, *Open Educational Resources (OERs)* and the European *FORGE* initiative provide a tremendous amount of valuable free learning content [2]. Such changes on the educational landscape make traditional books and classrooms almost obsolete. Interaction and interactivity are key to effective modern education. Further, program visualizations which are tightly integrated into eBooks, positively affected students' engagement [3]. In the same research it was noted that a significant number of students spent more time engaged and paid more attention to the learning material with interactive eBooks, which suggests that they used program visualizations attentively. Other studies presented that in kindergarten children, eBooks have the potential to improve a child's emergent literacy. Even more interesting is that this improvement is even more evident with children who had deficient skills when they enrolled school [4]. Therefore, it can be assumed that interactivity in the learning material can have positive effects on acquiring knowledge. This further opens doors to the application of interactive eBooks in other fields, and not just formal education (school system, universities etc.).

Based on the previously noted arguments it seems that interactive eBooks have only positive effects. Certainly, the whole situation is not that simple. Interactivity can have negative effects on attention and could drastically reduce effectiveness of non-interactive learning materials. There is a possibility that interactivity affects brain chemistry by releasing more dopamine, which in the long-term can have negative side effects. It is not clear how severe this issue is, but certainly, it is interesting and somewhat concerning.

This is why it is important to address the impact of interactive eBooks on education and learning overall. Acquiring knowledge is a complex process, thus it is necessary to address the mechanics of interactive eBooks and their application in formal and informal education. The structure of this paper follows the following research questions:

1. How effective are interactive eBooks compared to traditional learning material?
2. What are the advantages and disadvantages of interactive eBooks?
3. Are interactive eBooks enhancing the educational system?

These research questions are used as guidelines in the research process. This paper analyzed the importance and applications of interactive eBooks. Additionally, it addresses the future of education and the potential of interactive eBooks which can enhance the educational system. The first section of this paper discusses the applications and importance of interactive eBooks. The second section discusses the possibilities of interactive eBooks and its role in future educational systems.

II. APPLICATION AND IMPORTANCE OF INTERACTIVE E-BOOKS

Reading out loud to children has been found to be an effective way of increasing interest in literature and learning. Through hearing activities, children can increase their vocabulary and improve their listening skills [5]. This indicates that text-to-speech techniques are more potent compared to traditional silent reading. Exactly here, text-to-speech software can help children in their education process, as there is not always enough time in schools or at home for someone to read-out-loud a textbook or story to children. This type of text-to-speech interactivity function can be integrated into eBooks, thus making them an effective solution for enhanced learning.

Further, students can use interactive eBooks not only for text-to-speech functions, but there are other extremely useful functions such as instructional or demonstrational video, touch-screen gestures, simulations, audio and other types of content. Traditional textbooks can't even come close to such functions. It was noted that students can drastically improve their learning skills such as reading skills, writing skills, technological ability and understanding, cognition and critical thinking [6]. In the same research students noted that during their interactive studying sessions, they engaged in chatting and playing with their mobile devices. Interestingly, the latent lack of focus can be a result of the over-interactive learning approach. This assumption will be discussed later on in the paper.

Next, in another study it was noted that eBook interactivity had little effect on preschoolers' word learning [7]. In the same study it was pointed out that interactivity didn't disrupt he whole story telling activity and it didn't negatively affect story comprehension. In Japan, all the textbooks are being scheduled for replacement with interactive eBooks by the year 2020 [8]. It is evident that in education, interactive eBooks have certainly found their place. However, interactive eBooks can be used in other educational settings and not just formal educational facilities. These other educational settings can include seminars, training courses, business courses, and others. The interactivity aspect of eBooks is practical, effective and more efficient compared to traditional textbooks. Some of the applications of interactive eBooks include, but are not limited to:

- Text-to-speech software integration in eBooks. This is applicable in pre-schools as children are positively affected by listening read-out-loud text;
- Video and audio integration in eBooks used in manufacturing companies. This approach provides a more coherent learning material which further increases employee training effectiveness;
- Touch-screen applications for interactive storytelling for children and for application in manufacturing SMEs.
- Simulations and equations in various fields of engineering. This kind of interactivity provides the users the possibility to better understand specific mechanics of machines and mathematical equations.

Basically, the applications of interactive eBooks are numerous and they depend on the type of content in the eBook, the purpose of the eBook, genre, industry and user base. To depict the application of interactive eBooks in a concise way, a model of eBook application is presented on Figure 1.

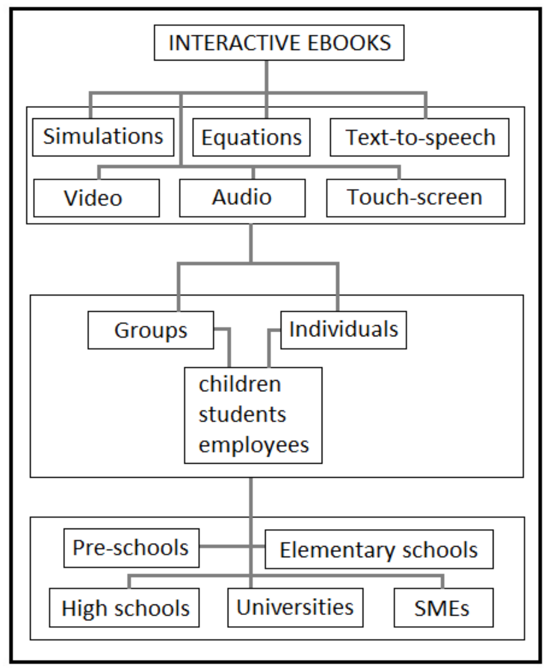

Figure 1. Applications of interactive eBooks

Furthermore, the importance of interactive eBooks is briefly addressed. The development of interactive eBooks started with the notion to improve the motivation of children to read. Research showed that interactive eBooks are more motivating and rewarding for children compared to the same non-interactive eBook counterpart [9]. The application of interactive eBooks is indeed important for the future of education. A structured and controlled interactive eBook can enhance the learning process of children and it can improve the intellectual capital (employees' skills and knowledge) of SMEs. Students can interact with each other through learning from interactive eBooks, and most importantly they can share notes, thus improving the learning process [10]. It is evident that interactivity, or more precisely, interactive eBooks are an important tool not only for students but for teachers and professors as well. In the section, interactive eBooks and its role in the future of education is discussed.

III. Interactive E-books and the Future of Education

In order to properly discuss the role of interactive eBooks in the future of education, it is necessary to address the potential negative effect of interactive eBooks on long-term learning. What kind of negative effects can arise from interactive learning? The key is in the word "interactive". Namely, interactivity offers more effective learning as it can stimulate the brains dopamine releasing mechanism. Higher levels of dopamine were detected among adolescents' who suffered from Internet addiction [itro22]. Now, the matter is really more complex, and interactivity doesn't mean causation of addiction, but it surely opens doors to discussions. The main concern with interactive eBooks is the large possibility that the stimulation and motivation effect will decrease over time and the aspect of interactivity will hinder learning in the future. This assumption is based on the literature analysis in this domain. Evidently, interactive eBooks are more effective when it comes to learning. Students find it more interesting compared to traditional textbooks or non-interactive eBooks. However, repeating and re-reading the interactive eBook may reduce learning effectiveness. In addition, students are prone to chatting with friends during the exchange of notes. Over-stimulation with a large set of tools which interactive eBooks may provide, can result in lack of interest in the learning material. This doesn't mean that students should abandon the use of interactive eBooks as there is a clear advantage over traditional textbooks and non-interactive eBooks. But research in this domain should be focused not only on the positive sides of interactive eBook application but the potential negative sides as well.

To broaden this discussion, an example of stimulation-fatigue is depicted on Figure 2.

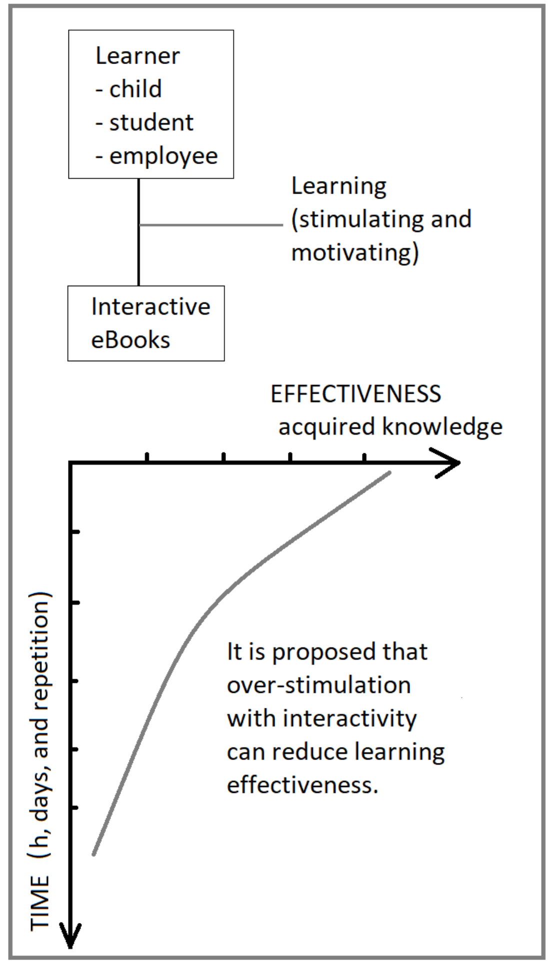

Figure 2. Potential reduction in learning effectiveness over time due to over-stimulation

As mentioned before, and now shown on Figure 2, over time and mainly due to repetition, the stimulating effect of interactive eBooks may decrease, thus reducing learning effectiveness. The learner practically builds up tolerance for the stimulating and motivating effect of eBook interactivity. This is yet just an assumption and a topic for discussion, but certainly it should be investigated in more detail.

IV. Conclusion

In this paper the application and importance of interactive eBooks was analyzed. In addition, the potential role of interactive eBooks in the future of education is discussed. Interactive eBooks have found various applications in various fields. The educational system is focusing towards the use of eBooks and interactive eBooks, thus their application in the future is imminent. Further, the research questions proposed in the "Introduction" section are addressed:

1. How effective are interactive eBooks compared to traditional learning material?

Research has showed that interactive eBooks can drastically improve comprehension and listening skills in children, and it can improve learning effectiveness among students. Compared to traditional textbooks and non-interactive eBooks, the interactivity aspect has a large advantage as it offers improved cognitive and meta-cognitive performance.

2. What are the advantages and disadvantages of interactive eBooks?

The main advantage is the interactivity as it engages the learner and it improves learning performance. As for disadvantages, interactive eBooks can have less of a motivational effect over time, due to over-stimulation, which further can affect long-term learning performance.

3. Are interactive eBooks enhancing the educational system?

No doubt. Yes. Modern educational systems have to integrate the use of interactive eBooks as they are more effective compared to traditional learning material. Text-to-speech software, video, audio, touch control, simulations and other tools present a modern approach to learning and studies showed they are effective.

This paper provides a significant basis for future research in this domain. For future research it is recommended to conduct a meta-analysis of previous research. In addition, the negative effects of interactivity should be addressed.

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Conceptual Errors - Serious Barrier in Math Education

M. Miteva, L. K. Lazarova, M. Ljubenovska
University "Goce Delcev", Faculty of Computer Science, Stip, Republic of Macedonia
marija.miteva@ugd.edu.mk, limonka.lazarova@ugd.edu.mk, marija.101967@student.ugd.edu.mk

Abstract - Math teachers in the high schools, and furthermore, the university math teachers, can testify that in general, the quality in mathematical training of students graduating high schools, and the acquired math knowledge, is decreasing. On the other side, many studies can point out that the most frequent phenomena in mathematical training of students is wrong acceptance of the concepts, which results in inability for dealing with those concepts and is serious barrier in math education and further application of mathematics. The perception created during our work with students over a period of ten years indicate that the students have distorted and incorrect knowledge of basic mathematical terms and concepts. In order to describe the situation, a test with basic mathematical question has been made for the students in the first year on different faculties. The main aim of this paper is to analyze the situation about such formal concept acceptance and to give conclusions and recommendations to cross over it.

I. Introduction

We know that mathematics is very exact subject and studying it needs thoroughly studying all its concepts and their relations. Making 'small' mistakes in math considerations and calculations can cause big difference between the obtained result and the correct one. The problem gets bigger if the wrong result is not simple math task or exercise, but it is needed for some application in concrete problem from everyday life or other field in science and society, and we know that mathematics is essential for solving different problems in physics, chemistry, biology, ecology, economy, engineering, etc.

Students usually find difficult the process of learning mathematics. One reason for this situation is the close relations among math concepts and inability to deal with those concepts if only one thing is not understood correctly. The wrong accepted concepts usually become serious barrier in students' math education. As they pass in each next grade the gaps in their math knowledge are getting larger and larger and students' confidence while solving math tasks is getting lower and lower. This situation very often results with students' giving up from mathematics, which further becomes the main reason why students avoid to study faculties where mathematics appears as essential subject, like natural sciences and engineering.

The problem with the lack of profiles possessing good math skills then becomes serious problem for the society. The science and society very often need people who can formulate certain practical problem and will be able to solve that problem. Overcoming the situation with the decreasing math knowledge and math skills among students in primary and secondary schools, seems to be difficult. The solution of this problem obviously could not be found easy, but obviously its beginning should start where the roots of the problem are: the primary school, and both students and teachers should be involved in overcoming the problems with mathematics. The first step in this, not simple and easy process, should be deep analysis about students' difficulties and the errors they do.

In [1] we can read about three types of math mistakes and how to prevent them. The math errors that students usually make could be classified in three categories: careless errors, computational errors and conceptual errors. The first type of errors, careless errors, occurs usually because students do not pay enough attention on the math problem they are solving, or the students are working too fast. This type of mistakes is not considered as serious barrier in learning mathematics, but they still cause wrong results. The second type, computational errors, occurs when mathematical operations are not applied correctly. One computational mistake in a work with many computational steps means that the rest of the work and the final result will be wrong. The third type of mistakes, maybe the seriously one, are conceptual mistakes. This type of mistakes occurs because students have not understood correctly math concepts and relations among the concepts. They use these concepts formally, paying attention on the form how something is written, not on the content of the problem that is presented, i.e. what is written. We consider this as serious barrier in further mathematical training of students and moreover, in the possibility for applying math knowledge anywhere. Thus, the importance of correct concept acceptance is significant. Similar point of view about math mistakes could be found in [2, 3].

Many research studies have been done addressing the mistakes that students make in mathematics, especially pointing out conceptual errors or misconceptions. These research studies are also emphasizing the importance and the impact of the conceptual knowledge which, in general, is difficult for the students to acquire, because the new concepts could only be built upon already well comprehend knowledge [4-14]. Research studies concerning conceptual errors in specific math area are presented in [15, 16].

II. EXPERIMENTAL RESULTS

In order to deal with a complex problem as the one explained in the previous section, it is useful for the first step to analyze carefully concrete examples of mistakes that students make, and then try to make theoretical conclusions for a general case. We have started to do such kind of analysis and we will present the current results in this paper.

During our work with students over a period of ten years, we have concluded that many of them have misunderstood variety of basic concepts in mathematics and are disabled to deal with those concepts. For example, students can easily find the value of the unknown variable x in the linear equation when the only variable x is on the left hand side, but if we change the sides in the same equation, many of the students are not sure what will be the answer (they easily solve in their minds $5x-1=4$ but if we set the equation $4=1-5x$, some of them are getting confused). Also, students can solve a system of two equations with variables x and y, but if we set a system with variables j and k, some of the students will also become confused. Students can learn to plot the graph of a certain function, but those who have accepted this concept formally, are not able to answer which is the value of the function in a given point, looking at the graph. Many of the students who can define real function with one variable and its graph, cannot recognize whether given curve in the plane is graph of a function or not (for example very often they consider circle as a graph of function). Students can easily plot the curve $y=x^2$, but they don't know how to plot $x=y^2$. Most of the students know that they can calculate square root only from non-negative number (working with the real numbers), i.e. $\sqrt{-8}$ doesn't exist in $\mathbf{R}$, but some of them are not sure whether $\sqrt[3]{-8}$ exists or not, and some of them will answer that $\sqrt[3]{-8}$ equals ± 2. There are also students that write $9x-1=8x$. Almost all of them know that $0:2=0$, but some of them also write $2:0=0$. Students can learn and perform operations with vectors given with coordinates in the space, but some of them are not able to answer what does the coordinates tell about the position of the vector in the space (actually, it is not determinate with the coordinates). Many students integrating $\ln x$ write as result $1/x$. These are minor number of examples about students' conceptual errors and it is not difficult to enlarge the list.

Wanting to recognize the level of students' conceptual knowledge in mathematics, when they have started first year on a faculty, and to receive a perception about students' math skills after finishing the high school (this will help us on the other side to determine the structure of the group we are working with), we have made on-line math test. Testing was done at the beginning of the academic year, for the students on Faculty of Computer Science at ours University. The questions with the offered choices and received answers will be presented in continuation.

About 85 students have answered the test with 15 questions with triple choice. The average grade of students' responses is 62,30% right answers. The standard deviation is 21,04%.

We have the top 5 questions with more than 50% wrong answers. The analysis for each question is given in continuation: the question with the lowest score, i.e. most wrong answers, was "$\ln 2x$ is equal to" and only 23,81% of the students choose the correct answer $\ln 2+\ln x$; 42,86% answered that it is equal to $2\ln x$ and 33,33% answered that it is equal to $\ln 2\cdot\ln x$.

The question "$\sin 2x$ is equal to" have 40,48 correct answers, $2\sin x\cos x$, but 38,10% choose the answer $\sin x+\sin x$ and 21,43% answered $2\sin x$, thus more than a half of the students have wrong responses.

The great numbers of students also have misconceptions regarding roots and negative powers. About the question "the term $\sqrt{2(a+b)}$ is equal to" most of the students, 48,81%, have chosen the wrong answer $\sqrt{2a}+\sqrt{2b}$; 41,67% answered correctly, $\sqrt{2}\cdot\sqrt{a+b}$, and there were also students, 9,52%, who choose $2\sqrt{a}+2\sqrt{b}$ as an answer.

About the question "$5x^{-2}$ is equal to" , 46.43% of the students choose the wrong answer $\frac{1}{5x^2}$, 42,86% of the them choose the correct answer $\frac{5}{x^2}$ and 10,71% answered $\frac{x^2}{5}$.

Regarding the term e^{ab}, less than a half, i.e. 46,43% have correctly answered that it is equal to $\left(e^a\right)^b$; 40,48% thought it is equal to $e^a \cdot e^b$ and 13,10% thought $e^{ab}=e^{a+b}$, which is surprisingly bed result (unable to compare the powers).

We have received exceptional bed responses about students' conceptual knowledge for cutting terms in algebraic fractions. Although the most of the students, 55,95% have correctly answer that $\frac{ab+c}{b}=a+\frac{c}{b}$, it is not small the percent of the students, 36,90%, that have cut b in the given term and answered $\frac{ab+c}{b}=a+c$. The rest 7,14% of the students answered $\frac{ab+c}{b}=a$.

Misconceptions regarding cutting terms in the fractions are very often phenomena. Students had three offered choices for the question "$\frac{\ln x}{2x}$ is equal to" and 32,14% have cut x and answered that the term is equal to $\frac{\ln}{2}$(here we can also recognize misconceptions for the function $\ln x$ and inability to notice that $\ln$ without x makes no sense); 61,90% have the right answer $\frac{1}{2}\cdot\frac{\ln x}{x}$ and 5,95% have answered that the term is equal to $\frac{\sqrt{\ln x}}{x}$.

Determining equivalent term with $(x+3)^2$, 27,38% have the wrong answer x^2+9; 69,05% have the correct answer x^2+6x+9 and 3,57% of the students choose it is equal to x^2+6.

Even through the other seven questions were answered with approximately 75% correct answers, having in mind its basicness and simplicity, we can say that it is inadmissibly for graduated high school students ambitious for academic degree, to make such conceptual mistakes.

About 26,19% of the students that have done the test have misconceptions for simplifying terms like $x^2 \cdot x^2$; 15,48% of them have responded $2x^4$ is the simplification for the previous term, 10,71% have chosen $2x^2$ and the other 73,81% have the right response.

About the term $4+2x^2$, there still are students thinking it is equal to $6x^2$ (21,43% have chosen this answer as the correct one); 77,38% have chosen the right equivalent term $2\left(2+x^2\right)$ and insignificant 1,19% thought $12x^2$ is the correct equal term.

The same number of correct answers have the question searching an equivalent term for $\frac{3}{5x}$. 14,29% of the students find out that $\frac{3}{5}x$ is the same term as the previous one, and 8,33% answered that $5\cdot\frac{3}{x}$ is the right one. The rest 77,38% answered correctly choosing the term $3\cdot\frac{1}{5x}$ as the right one.

The question asking for the solution of the equation $2x=0$, have 77,38 right answers, but some of the students think that $x=-2$ is the solution (17,86%) and the rest 4,76% have responded that the given equation has no solution.

The last three question were: recognizing an equivalent term to $3x^2+2x$ with 20,24% wrong answers (14,29% have answered that it is equal to $5x^3$ and 5,95% have as a response $6x^3$); finding the solution of the equation $-4+x=-8$ which also has 20,24% wrong responds (14,29% have chosen $x=-12$ as solution, 4,76 have chosen $x=2$ as solution; the others had no answer) and calculating the value of the term $\frac{1}{3}+\frac{3}{4}$, 13,10% have given wrong answer, some of them writing it is $\frac{4}{7}$ and the others $\frac{1}{4}$.

We will mention here that only 2 students, which is 2,35% of the whole number of students who have done the test, achieve the score 15, i.e. all answers given correctly; 7 students (8,24%) achieve the score 14; then 9 students (10,59%) achieve the score 13; all other students have done mistake on three and more questions.

The general perception, after receiving the responses of the questions in the test, is that the numbers of students that have incorrectly accepted many mathematical concepts and make different conceptual errors, is not small at all. It is not easy to exceed such problem. It is in practice impossible to achieve a situation without mistakes in students doing math, but with a serious effort, it could be add up to smaller number then the one in the result of previously described test. The process should start in the earlier grades. The problem based learning [17] can have contribution in it. Paying greater attention what is the content of the formula and certain procedure, explained parallel with many examples, could also contribute to get better students results in learning math. Setting real life problem first and then introducing new concepts and relations among them, needed to solve such real problem, could results with clearness in understanding mathematics. This cam also increases the motivation for learning mathematics. However, the process is not easy and is searching deep dedication of the teachers teaching math.

III. CONCLUSION

This analysis based on a test with 15 questions is maybe not large and explicit, but it could serve as good starting point in an attempt to overcome as more as possible problems with wrong accepted concepts in math education and to decrease the number of conceptual errors that students make while solving mathematical tasks and other problems which need application of mathematics in their consideration. We have introduced many misconceptions that students are facing up with, which appear as serious barrier in further studying mathematics and ability to apply misunderstood math concepts in different everyday situations and different problems while studying other subjects at school, and in certain problems in the science, techniques and society after that. The necessity and the importance to get rid of those problems are obvious, but not easy. Increasing motivation for learning mathematics is closely related with better conceptual acceptance in mathematics. In the last years many researchers are interested in this topic, but the attempts for crossing over such situation are obviously not enough yet.

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Implementing Video Presentations and Students Reactions in ESP Classes (Study Conducted at the Language Centre-Tetovo, SEEU)

N. Radosavlevikj, H. Hajrullai
South East European University, Language Centre, Tetovo, North Macedonia
n.radosavleviq@seeu.edu.mk, h.hajrullai@seeu.edu.mk

Abstract - This is a practical session where as an ESL teacher I implement video presentations in my ESP (Law, Communications and Public Administration) classes as well as investigate student's positive reaction and motivation in a multilingual classroom. Most of these students come from a different background and are multilingual. According to the Comprehension-based Approach videos were considered the most appropriate visual aid when the teachers were not native. This method was also based on the idea the L2 learning was similar to L1 acquisition, so students received a lot of audiovisual input in the first stages of the learning. Linguistic meaning is based on usage and experience, so students should use the language for real purposes as many times as possible. The study was conducted with 17 students' studying ESP course (Law, Communications and Public Administration) and the objectives for this study are to enhance their speaking skills for professional communication as well as improve their expression.

I. Introduction

English for Specific Purposes 1 (Law, Public Administration, International Communication)

English for Specific Purposes 1 (Legal studies, Public Administration, Communications) is a one semester course, including four class hours per week for 15 weeks. It focuses on the development of student's language proficiency and subject-related vocabulary. It helps students develop academic writing and reading skills and discuss articles and lessons in the fields of Law, Public Administration, Political Sciences and International Communication as part of their speaking skills. The materials used in this course are from different sources, such as Internet and professional English books for Legal studies, Public Administration and Communication. The teacher adapts materials in order to meet student's specific and professional needs. During the course teachers and students used the software management system Google classroom either for assignment delivery, discussion forums or to follow up classroom activities and tasks.

The main objectives for the ESP course conducted at SEEU are:

1. The basic objective is to enhance students' speaking skills
2. The second objective is to improve their speaking skills by delivering a presentation on a particular topic selected
3. The third objective is to improve their expression
4. The final objective is to heighten their communicative skills

Based on the objectives students are assessed on several criteria: Attendance and Participation during the course 10%, Discussion Forums 10%, Assignments in class and for homework 10%, Delivering a Presentation on a topic related to the field of study 15%, Presentation feedback 5%, Job interview, writing a Curriculum Vitae and Cover Letter 10% and Final Exam 40%.

ESP courses help students build up professional knowledge in their fields of study and experience English as a second language in the class by actively participating during the class, debating on a specific topic, selecting a topic for presentation in class depending on their interest and field of study as well as practice the target language in best of traditional and online setting.

At the same time, students are getting prepared for their profession (writing a Curriculum Vitae and Cover letter as well as practice Job Interviews). According to the curriculum students in this way practice soft skills and are getting prepared for their profession.

It is important for the ESP teacher to act as a facilitator and try to use authentic resources in that way stimulate students to participate and communicate in class in order to meet their professional needs.

A. Enhancing various language skills

Using video materials in ESP courses is especially useful because it can enhance student's language skills such as listening, speaking, writing, reading and grammar. The authentic content of the video could be used for introducing interesting topic relevant to student's field of study and at the same focusing on introducing new words, grammatical concepts and other enhancing communicative activities. Furthermore, the educational content of the video can be used to motivate students' enhancing their speaking and writing abilities. This includes activities such as discussion, debates, role-plays, dialogues, and group presentations (Wolf, McGill &Tuzi el al., in Morat & Abidin, 2011:96).

According to Mekheimer (ibid.) the integration of video based material, "including satisfactory viewing comprehension and presented in an integrated language skills instruction, is a valuable approach to whole language teaching".

Videos can be used for the purpose of integrating all these skills through activities such as guided practice, interactive discussion forums, among all the students and also with the instructor. The instructor should also pay close attention to various characteristics such as the proficiency level in ensuring success.

The value of video "is highly correlated to its integration within the curriculum-in other words, how closely the content fits into the overall instructional sequence" (CPB,2004:11). Video can be used at the beginning for introduction of a topic, during a unit or lesson to stimulate discussion, or as a means of reinforcing or reviewing the content.

Engaging students with video activities requires creating the right setting for such learning to occur. A six-year study of mass media in two Massachusetts school districts reveals that film and video are still often used for non-optimal purposes, including filling time, keeping students quiet, break from learning or as a reward for good behavior (Hobbs as cited in Cruise 2009:16).

Crucial for viewing the video might be setting expectations for the students and providing a context for the activity. Using a short video can be effective because it gives general description of the material and also makes students interest to catch the material by its performance.

It also sharpens students' ability in building concentration. Teacher can modify the material, and balance by understanding the material explained by the teacher. It is believed that students who taught by using short video have good achievement because they can master the material of the lesson. Denning (in Cruse 2009:16) fears that without proper instructional context and guidance, video, like television, may condition viewers to be insensitive or to feel helpless in the context" of events being watched.

Video is a visual medium and it is important when selecting the video to have strong, visually-rich educational content which is the main element for maximizing the effectiveness of the video. Educational video with instructional and cognitive elements can help improve student's comprehension. Videos with closed captioning can promote learners' reading fluency and motivation to read (Cruse 2009:17).

Video becomes effective and stimulates student's critical thinking skills if the following elements are embedded:

- Variation in the presentation
- Humor
- Age-appropriate narration and developmentally- appropriate thinking skills
- Chunking, or organization in sections
- Provision of meaningful examples
- Posing of open-ended questions
- Opportunities for students to carry out individual thinking
- Opportunities for extension
- Teacher guides outlining possibilities for previewing or extension activities. (ibid.)

In order to become effective Video must convey information both auditory and visually. Educational video stimulates students and reinforces reading and lecture material. Furthermore aids in the development of a common base of knowledge among students, enhances student comprehension and discussion, provides great accommodation of diverse learning styles, increases student motivation and enthusiasm and promotes teacher effectiveness. (Cruse 2009:2).

B. The impact of video enforcing interest and motivation in the ESL classroom

Motivation is one of the most important elements in the process of learning by using multimedia. The instructor should be able to stimulate students and lead them through the phases of learning. For that purpose the instructor should plan the video materials and incorporate them in the syllabus design. The factors that influence motivation are the material used and the media included, they are both interrelated. There is a very close relationship between what the teacher teaches, the materials used in class and how well the students understand it. To make students understand about the material the teacher should choose the most suitable media. Using only the traditional media and method is not effective enough so it's useful to be combined with the modern technology in order to build quality in teaching and learning.

There is very little research on how the video affects motivation and it addresses the question of whether the use of video has a positive effect on student's interest and motivation?

This quantitative study examines the effects on motivation and the study was designed to establish the impact of video in the ESL classroom on students' motivation. Do students respond positively on the effects of using video in the classroom?

Are classes more stimulating and more interesting and as such are students more motivated when video is one of the crucial elements of the curriculum.

C. *Findings and Results*

For the purpose of this research, a study was conducted at the Language Center, at the South East European University in Tetovo (onwards referred to as SEEU). The reason why the study was conducted at this particular center is because the Language center at the SEEU in Tetovo is a central part of every SEEU student's academic career, both as required subjects and as optional elective courses. The University's mission is to promote a multilingual approach to learning, stressing both the importance of local and international languages and Language Center's primary mission is to provide courses specified in the curricula of the five SEEU faculties. For this purpose, The Language Center offers classes in English starting from the basic skills up to English for specific purposes in fields such as law, computer sciences, public administration and business administration.

This particular research was carried out during fall 2018 semester with students of mixed ESP classes such as Computer Sciences 1 and ESP classes for Public Administration 1 as well as students of Academic and Advanced Academic English. A Likert scale quantitative questionnaire was prepared on Google forms and sent electronically as such to students during class as well as outside the class. A total number of 87 students have responded to the questionnaire and their answers certainly reflect the very positive trend of integrating videos in ESP classes at the Language Center.

Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. In ESP classes, teachers often use videos to teach a class	19	50	11	7	0
2. Videos help me focus better on the content of the lesson	24	47	13	2	1
3. Videos help me understand the content more effectively	31	39	16	1	0
4. Videos help me memorize the content	24	45	14	4	0
5. I have been asked by my teacher to create a video content as part of a classwork/homework	4	14	26	33	10
6. Videos are a great source to start a class discussion/debate	24	45	17	1	0
7. Videos are used in my class to start a debate/discussion	9	30	26	19	3
8. Videos make me think critically	8	49	23	6	1
9. I have been asked to write a critical analysis of a video in a class	14	22	18	27	6
10. I would prefer more videos to be used in ESP classes	21	43	19	4	0

The findings of this study show that student interest about video materials was higher compared to standard lessons, using only the standard book-ESP reader. Some of the students stated that they actually learned something from the lessons. The study doesn't show if videos increased student attitude and motivation. In addition, students were more stimulated when video was used and their curiosity aroused. It helped them enjoy as well as learn and become more confident in the target language.

II. CONCLUSION

Video is a visual medium and can be used as a valuable tool especially when used as part of active learning approach. It is an effective intrinsic motivator and it show that it has positive impact on student motivation when implemented in an ESP course.

Furthermore, video is an important tool for stimulating students to learn a language. It provides listening to real-life situations, communication and it promotes language acquisition. It has been argued by the researchers that watching a video is rather a passive activity where viewers are passively reactive to what they are watching.

However, studies showed that watching a video is an active process, " an outgoing and highly interconnected process of monitoring and comprehending" and " a complex, cognitive activity that develops and matures with the child's development to promote learning" (Marshall, 2002:7).

Video promotes high cognitive activity necessary for active learning: "well-designed multimedia instructional messages can promote active cognitive processing in students, even when learners seem behaviorally inactive" (Mayer, 2001:19). Crucial elements in promoting motivation and engaging students as active learners are the content and the context of viewing.

Content should be appropriate and match the age and the skills student's posses. Interesting content and context can engage and activate student's minds as well as promote learning and critical thinking skills. Another factor that is very important is how the information is delivered through the medium and how the viewers perceive it. In this context, aspects that should be examined are students multiple forms of intelligence and the use of multiple modes for content delivery. Multiple intelligences are important because “they dictate the ways students take information, perceive the world, and learn” (Marshall, 2002:8).

Mirvan (as cited in Woottipong 2014:204) points out that video materials in a classroom can enhance students’ motivation to learn and expose them to variety of situations that can help them comprehend similar situations in real life. The information presented through the video can be entertaining, contextually exclusive and can reflect real –life communication in a natural context and setting. Videos also provide topics and ideas for learners to discuss in class. In order to choose a video material for the classroom, topics should be interesting for students and chosen according to student’s proficiency level of English. In this way, the instructor is a reflective observer that designs a cycles of activities for engaging students giving them opportunities to study with the use of video materials.

Video materials are exposing learners to the language used in variety of contexts and offering a chance for language learners to test their comprehension as well as demonstrate their comprehension. Moreover, they have the potential to maximize students’ natural abilities to acquire, process and use their knowledge. Video materials are challenging because depending on the topics and activities in class and outside the class, students can take on the role of the educator playing an active role, participating in discussions online or video record themselves.

Engaging students in the process of learning and by using instructional media technologies enhances student’s access to information, applying information, communicating with other students and in that way making the whole process engaging and active.

In a conclusion, the advantages of using video in the classroom makes students’ observe authentic materials. Using the videos, TED talks on youtube, episodic series, movies help students develop both visual and aural elements especially viewing communication such as body language, gestures, context clues, cultural symbols and if videos are used as supplementary material to the standard ESP textbook can develop deeper understanding of the target language.

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From Traditional to Modern Teaching by Introduction of Electronic Textbooks – Pedagogical Implications*

L. Tomčić**
University of Novi Sad, Faculty of Philosophy, Novi Sad, Republic of Serbia
lana.tomcic@gmail.com

Abstract - The aim of this paper is to determine the pedagogical implications of introducing and applying electronic textbook in teaching process. The goal is achieved at the theoretical level, using the method of theoretical analysis and content analysis techniques. The first part deals with the changes that have occurred in the educational system by the introduction of information technologies, while the other parts of the paper determines the movement from textual to electronic textbooks, through analysis of their definitions, characteristics, advantages and disadvantages, as pedagogical implications of introducing and applying electronic textbooks in the teaching process.

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**Student of doctoral studies.

I. Introduction

Accelerated social changes created by the faster development of information technologies put complex issues ahead of the education system: how to innovate traditional teaching by introducing information technologies while preserving its most important qualities, how to keep students attention, how to motivate them to learn, or how to adapt teaching to new, digital generations, development, which is happening every day faster? How to train teachers to work with students who are more informed about modern technology and technology flows than themselves? The answers to these and similar questions are trying to give critics of the traditional school for several decades. Following the global trends, electronic textbooks are introduced in the teaching process. Among the first issues that arise are the following: how did we come from classical textbooks to modern, electronic, which is the difference between them, whether students are ready to accept new changes and, from a pedagogical point of view, a key question: are the shortcomings of classical textbooks represented advantages of electronic, and vice versa? This paper is an attempt to answer some of these questions.

II. From Traditional to Modern Teaching by the Introduction of Information Technology

The basic problem of education is how to get from a traditional school with all its characteristics and weaknesses to a modern one where all the students will be satisfied and successful. It is necessary, as per the modern theoretical conceptions to:

a) make the educational process based on teaching be transformed into the process of studying, which means that a student has to be the subject of that process;

b) make the teacher relate to the student as an autonomous person;

c) base teaching on a rich interaction as a social relationship;

d) pay greater attention to not only the acquisition of knowledge but also to the moral and evaluating formation of a student;

e) make the teaching work not a simple transfer of knowledge but enable the organization of a working and mental activity of the student [1].

In order to develop higher-order skills, it is necessary to apply information-communication technologies in teaching [2]. The traditional student of today is part of the Net Generation who has been raised in an era of instant access. Their communication and learning is complemented by the Internet, a major influence on this cohort. The regular method of contact is text messaging, instant messaging and cell phones. Learning methods for the Net Generation include Internet tools such as Web-CT, Blackboard, online courses, online journals and i-pod downloads. Are they ready to also change from print textbooks to Internet based textbooks? [3].

III. From printed textbooks to electronic textbooks

There are numerous attempts to define textbooks, so authors Avramovic and Vujacic [4] point out that the textbook is „a source of knowledge and an instructive tool. In structural terms, it consists of the basic text (content) and the didactic-methodical apparatus (way of presentation)". In Article 2 of the Law on Textbook and Other Teaching Resources of the Republic of Serbia, the textbook is defined as: „a basic didactically-formed teaching tool, in any form or medium, used in educational work at a school for acquiring knowledge, skills, forming attitudes, encouragement of critical thinking, improvement of functional knowledge and development of intellectual and emotional characteristics of students, whose contents are set out in the curriculum of teaching and learning and approved in accordance with this Law" [5]. Authors Vasilijevic and Djurovic [6] give the following definition of textbooks emphasizing its pedagogical value: „The textbook is a book with a strong educational influence on young generations, a source of knowledge and means of transferring knowledge, with scientific content placed in a specific way, which is why the textbook has expressive pedagogical value".

An e-book is „a monograph, a digital audio version of a text workbook, a literacy book, a children storybook, and a textbook available on CD; DVD; CD-ROM and through websites of different institutions; institutional repositories, commercial and non-commercial databases. Its content is readable using a variety of hardware devices (personal computers, tablets, e-book readers, smartphones etc.), and for its download to a portable device and reading, the Internet access is required" [7]. Although, some publishers are more inclined to, instead of the term e-book, use the term interactive storybooks, interactive e-books, books in app, etc. for referring to a medium of e-book containing some sort of enhancement [8].

Since 2010, developed countries of the world, the United States, Great Britain, Canada, France, Poland, Slovenia and others have introduced a pilot project for the procurement and use of e-textbooks on tablets and mobile devices in teaching hours. The results of the research have shown that the tablets represent an inescapable didactic material in contemporary teaching, as a basis for various digital contents and an interactive e-textbook. The number of e-books, as well as their application in the educational process is growing daily in the world, it is evident that it becomes integral part of primary and secondary education [9].

IV. Pedagogical implications of introducing and applying electronic textbooks in teaching process

The people who are most likely to use electronic textbooks are primarily current students within the age group typicall referred to as Generation Y. The perception of Generation Y (Gen Y) is that they are individuals who "want it all" and "want it now" and are constantly connected through technology. Accoding to the research, the students' primary reason for preferring digital to printed books is that all required course materials are in one place. With the number of books students are required to buy each school year, it makes sense that they would prefer to have access to those books in one place instead of carrying individual books everywhere [10]. Similar results were obtained in other studies, where it is shown that university students are increasingly choosing to purchase e-textbooks for their mobile devices as an alternative to traditional textbooks. Results demonstrate that there was no difference in cognitive learning and grades between the two groups, suggesting that the electronic textbook is as effective for learning as the traditional textbook. The mean scores indicated that students who chose e-textbooks for their education courses had significantly higher perceived affective learning and psychomotor learning than students who chose to use traditional print textbooks [11]. In some other researches, participants who had previously used an e-textbook still preferred print texts for learning. Despite the ability to easily access supplemental content through e-textbooks via hyperlinks and other features, students were more likely to use special features in print textbooks than in e-textbooks. When available, students chose to use the printed textbook; however, when the e-textbook was the only format available, they used it [12, 13].

When preparing electronic textbook to be usable media in the teaching process, electronic textbook designers must consider the following questions:

a) Is it used as a singular source of knowledge or as an integral part of a multimedia teaching package?

b) Is the media used without the instructive help of the teacher or with a certain (how much?) instructive help?

c) For which education level is the media intended?

d) What kind of teaching tasks should be accomplished with the help of the media?

e) What is the mental condition of the subjects to whom the medium is intended?

f) What are the relevant experiences of potential users? [14].

Only a textbook, either classical or electronic, containing general and specific didactic-methodical values, based on the principles of individualization and socialization, taking into account the general characteristics of students of the same age, as well as the principles of thoughtful verbal learning and learning through discovery can be considered modern . Therefore, the classical and electronic textbook should not be opposed, but it is necessary to consider them in creative synthesis, which will overcome their weaknesses and in the first place emphasize the advantages [15].

Pavlovic [16] lists the following advantages of using e-textbooks in teaching, in relation to the printed textbook: the material that the student should learn is presented in a much more picturesic and fun way, avoiding co-existence and monotony; students are animated by more cognitive senses, and in this way they enable better learning and adoption of facts and the development of performances; there are no outdated content in textbooks - all changes are entered and immediately available to each student; positively influences educational achievements because it enables the use of various sources of knowledge, that is, information bases; individualization of teaching is provided - student acquires knowledge and skills in accordance with his own needs, abilities and affinities; 86% of European teachers say that students are more motivated and attentive when multimedia is used in class; the use of multimedia has a positive impact on communication skills and thinking skills; students take greater responsibility for their own learning; multimedia allows learning by using different learning styles; multimedia software ensures the quality of content or teaching; spatial and temporal unrestricted acquisition of knowledge and skills (not only in the school environment, but at home, at the excursion, on the journey, etc.); the multimedia system allows the teacher to greatly enrich his ability to monitor and evaluate teaching and students; feedback is not delayed, as in traditional teaching, but in a multimedia e-textbook, the student continuously receives feedback and, if necessary, additional information; does not occupy much memory space on a computer or a portable device, the user can store more e-textbooks and create libraries; there are no "heavy textbooks" that students wear in bags; digital publishers do not spend money on paper, printing, storage, transportation, distribution and intermediaries, and as a result, the prices of e-books are considerably lower; e-textbooks protect the environment because they do not cut wood for paper.

Disadvantages of the use of e-textbooks in the teaching process are reflected in the limited educational role of teachers and the socialization of students [16]. There have been concerns about the side-effects of long-term usage of e-textbooks on students' health. The problem is pronounced for some reading devices that have a small screen size. Further efforts are necessary to investigate possible side-effects of prolonged usage of e-textbooks, as well as to reduce fatigue, particularly eye fatigue, when reading e-textbooks, and to provide most features found in paper-based textbooks, as well as to provide a printed-page-like reading experience [17]. It has also been argued that e-textbooks exhibit the potential for complexity, leading to various difficulties associated with usability and some e-textbooks may promise complex added functionality, but actually deliver limited multimedia features. It is also necessary to ensure that there is sufficient memory space on computer hard disks both to store the electronic text and run the software which could cause problems in schools where computer equipment is not particularly up-to-date [18].

V. CONCLUSIONS

The introduction of innovation in the teaching process has led to many doubts, fears and questions. The results of the research on the effectiveness of electronic textbooks have divided the opinions of the experts, so we have one that optimistically believes in innovations and others who are advocates of the traditional school. We are aware of the fact that there are no ideal textbooks, that classical and electronic have their advantages and disadvantages. The task of all actors in the educational process and creators of education policy is reflected in finding ways to implement electronic textbooks to improve the teaching process without losing the good side of traditional teaching, bearing in mind, above all, the educational role of teachers and the development of students' socialization as the main disadvantages these innovations. At the theoretical level, the solution is to use electronic textbooks as an additional teaching tool, until the conditions for its optimal application as a basic teaching tool are fully met. Teaching practice will show when the time for that will come.

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Enhancement of Education Process Through Immersive Virtual Reality: Technological Scope of LIRKIS Laboratory

B. Sobota, Š. Korečko, M. Hudák, M. Sivý
Department of Computers and Informatics, Faculty of Electrical Engineering and Informatics, Technical University of Košice, Slovak Republic
branislav.sobota@tuke.sk, stefan.korecko@tuke.sk, marian.hudak.2@tuke.sk, martin.sivy@tuke.sk

Abstract - This article presents a technological scope of LIRKIS Laboratory and its impact on improvement of the education process. The introduction aims at Virtual Reality technologies and systems which produce fully immersive virtual environments and can be dedicated to virtual learning. The second section focuses on virtualization sequence and 3D model processing as one of the most important stages in LIRKIS courses. Section three relates to the equipment of the LIRKIS Laboratory and its availability for students within education. All of the education methods and surveys were focused on improvement of the quality of teaching are described in section four. The conclusion summarizes survey results and introduces potential use of VR technologies of the future education process.

I. Introduction

In recent years, there has been an increasing interest to utilize Virtual Reality (VR) in the process of education. A key issue was building and visualizing powerful Virtual Environments (VE) to provide a realistic immersive experience. Nowadays VR technologies offer a wide range of application focused on real-time 3D simulations, virtual training, education, medical courses, and engineering science [1]. Thanks to these features, it is possible to use VR systems to be used in a variety of purposes. One of the major topics to be investigated in this field is the possibility of increasing the quality of virtual education with fully immersive VE [2]. Immersive virtual reality (IVR) contains an artificial environment which replaces physically available users' real-world. There are several IVR systems to provide more satisfying user experience such as Virtual CAVE, Head Mounted Displays and Smartphone VR Headsets. Considering their availability and transportability, there is no limitation to use them in only one place.

The LIRKIS Laboratory (Laboratory of Intelligent Interfaces of Communication and Information Systems) at the Technical University of Košice, Department of Computers and Informatics mainly focuses on enhancing education process through immersive VE. Presently utilized technologies and interfaces in the laboratory are performing more natural Human-Computer-Interaction (HCI) prior to previous equipment. Furthermore, the LIRKIS is has significantly enhanced by various types of input and smart devices to ensure any type of human interaction with virtual environment. Through extending laboratory's equipment there is an opportunity for students to gain experiences with working on different IVR systems and interfaces.

II. Virtualization Sequence and 3D Model Processing

The LIRKIS laboratory concerns primary on education in 3D computer modeling and visualization. Therefore, the main criteria featured in learning are directly oriented to process called Virtualization sequences shown in the Figure1. The laboratory is equipped to offer all of the sequences from technological resources such as hardware and software. Both of them are responsible for proper functionality and support of all of the virtualization process.

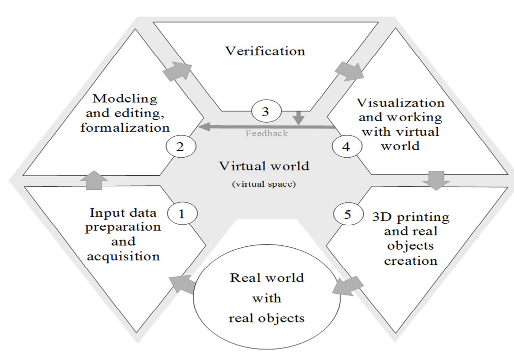

Figure 1. Process of the Virtualization sequence.

Modeling and editing of 3D structures are mostly provided by specific software tools while process of visualization is performed by Virtual CAVE, Microsoft HoloLens and VR Headsets (similar to HMDs).

III. Technological scope of LIRKIS Laboratory

The utilized VR technology is fully available for students during practices, exams and similarly in the course of pre-graduate, graduate and post-graduate. All of the chapters explained below describe currently used IVR systems and devices conducted to improve education in the field of fully immersive VR.

LIRKIS CAVE

The LIRKIS CAVE [3] represents specific unique VR system with fully immersive VE. The static construction of the LIRKIS CAVE has hexagonal shape containing 20 LCDs screens to provide natural peripheral vision. The projection of VE utilizes passive stereoscopy system with overlaying two images rendered for each eye separately. The stereoscopy is fully adaptable thanks to using the OptiTrack system with motion tracking of user's and with its angle of gaze. Compared to other CAVEs, the LIRKIS CAVE is unusual due to its transportability. Whole system can be disassembled, then transported and finally assembled again. In the previous period, the system was extended with various communication interfaces to provide continuous data transmission with multiple peripheral devices and applications.

Smarphone controllers

Utilization of smartphone devices simplifies users' control of virtual object. We intended to provide multiple interactions to support virtual collaboration among several accesses [4]. The smartphone application (Figure 2.) ensures a fully flexible user interface that can be modified by scene context. Mainly used features are virtual joystick, three-axis gyroscopes, accelerometers and voice recognition. Real-time virtual collaboration positively affects education when a group of students communicates with each other and manipulates the same object together. Integration of smartphones allows student to participate with their own devices.

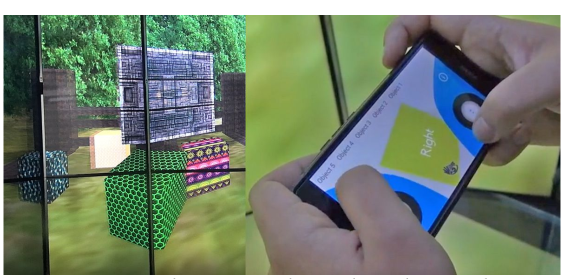

Figure 2. 3D object manipulation through smartphone.

Gesture recognition

MYO armband (developed by Thalmic Labs) represents an intelligent interface to detect electrical activity in human muscles. The MYO, as shown in Figure 3., is equipped with eight electromyography (EMG) sensors working on sampling rate between 200 and 1000 Hz. Other featured sensors are similar to smartphones such as highly sensitive nine-axis IMU with three-axis gyroscope, three-axis accelerometer, and a three-axis magnetometer. The whole device is physically adaptable and can be worn on any limb of human body. Monitoring muscle tension is helpful to control 3D object in more natural manners [5]. The communication between the device and other system is ensured via Bluetooth or USB.

Figure 3. Integration of MYO armband to operate with 3D object.

Microsoft HoloLens

The most recent Mixed Reality (MR) device used in the education process is Microsoft Hololens [6]. Its primary purpose is to merge 3D holograms with real-world surrounding the user (Figure 4.). Students can easily manipulate with artificial objects by hands-free gestures (e.g., voice commands) in real-time. All of the hand gestures can be associated with particular commands to control virtual object coordinates in physical space. Through recognition of artificial objects with physical surrounding, it is possible to detect their collisions which allow the user to manipulate them more naturally. The main objectives of usage of Microsoft HoloLens in the LIRKIS laboratory are closely related to training, education and human cognitive experiments. Within all of the activities, students gain more amusing experiences, which positively affect learning process.

Figure 4. Microsoft HoloLens Mixed Reality.

VR Headsets

Smartphone VR Headsets offer full compatibility with a variety of smartphones. In the LIRKIS Laboratory, there are utilized wearable smartphones VR without limiting a user by using cable connectivity (Figure 5.), unlike standard computer HMDs. The visualization is directly centralized in smartphone and provided by VR application. All VR development toolkits used in LIRKIS are focusing on web-based and cross-platform 3D applications. Students can work on their projects without the need to install special IDEs, the entire development and testing platform is available on the web. In addition to the development of virtual environments, the implementation of input devices is included in education. Frequently used input devices are VR joysticks, gamepads, and smartphone sensors. The final use of VR Headsets also serves to simulate various tasks which involve students in virtual collaboration.

Figure 5. Cross-platform VR headsets.

IV. Laboratory and Education Methods

In terms of teaching, our approach focuses on increasing student interest and the quality of our work in education. For this reason, we expand teaching opportunities with different types of VR technologies. In order to improve teaching, we make technology more accessible to students and more intense than previously. Our experiences were published in [8], [9]. We are truly interested in feedback from students, which we consider as important to improve the learning process. In the process of education, students have unlimited access to VR devices and technologies to gain lots of experiences. All of the technologies are actively used in the courses of Systems of Virtual reality (SVR) as well as Computer Graphics. In our interest to find out current feedback from students we created two simple questionnaires. The survey was held in a group of 22 students from SVR course to answer questions.

First Questionnaire

The first questionnaire contained 15 questions focusing on teaching the subject (4 – best, 0 – worst):

1. Training in appropriate areas.
2. Ensuring literature.
3. Explanation of the requirements and criteria of the subject.
4. Subject had a coherent approach.
5. Demands of the subject ware reasonable.
6. The lectures were interesting and beneficial.
7. The seminars are practical and well targeted.
8. Teachers worked professionally.
9. Teachers properly managed exercises.
10. Teachers have succeeded well in giving advice to the students.
11. All of the available LIRKIS technologies were optimally used during the course.
12. Teachers had a friendly and empathetic behavior.
13. They managed to keep the boundaries of social communication and worked with humor
14. Teachers communicate well with students and answer questions.
15. The course was important for me and it was interesting.

The average rate of evaluated results (Figure 6.) obtained from the first questionnaire shows that Expertise interpretation, environmental conditions, and complexity of the course were rated more than 87% which is less by 3% than previously published results in [8], [9]. On the other hand, the student motivation increased more than 15% in contrast to previous periods.

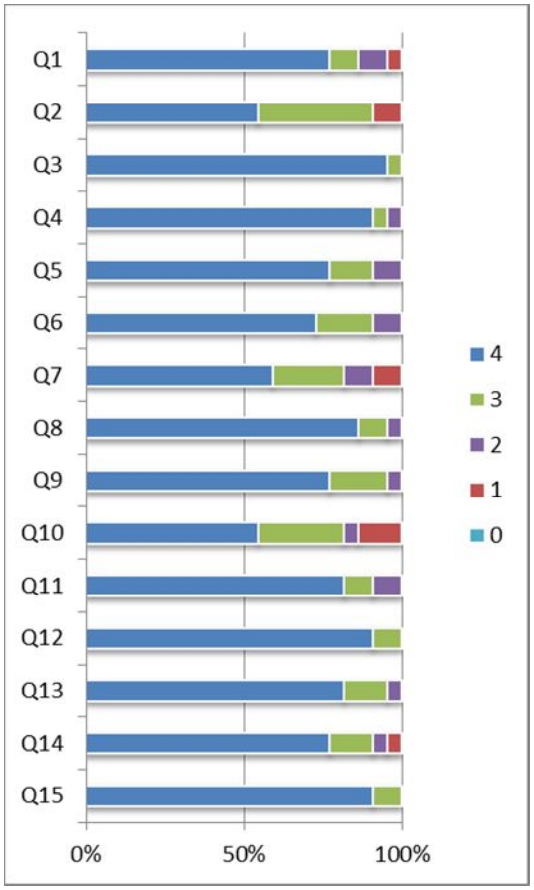

Figure 6. Results of the first questionaire.

Second Questionnaire

The second questionnaire was aimed on the evaluation of technological equipment utilized in the course named SVR. The results have shown that the LIRKIS CAVE has a positive impact on students' concentration in 87% of cases which shows that implementation of peripherals and gesture recognition were successful. Rest of devices such as Microsoft HoloLens and Smartphone VR Headsets achieved results of 90% which conclude they are suitable for the process of education.

V. CONCLUSION

Virtual-reality has the greatest progress in the present. All of current VR technologies improve the creation of previously impossible procedures. Thanks to the progress of HMD and Smartphone VR development, the interactions between human and computers are more immersive and intense. Based on our experience, we consider the use of modern VR technology as beneficial and cost-effective in education. In the future, we propose using virtual collaboration as a convenient way to work with groups of people within one shared virtual space. This option can be highly effective equally for educators and students in terms of accessibility, adaptability and rapid development.

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Encouraging Active Learning of Java and R Through the Use of Git Code Repositories

B. Tomić, N. Milikić, J. Jovanović, V. Devedžić, D. Đurić, Z. Ševarac
University of Belgrade, Faculty of organizational sciences, Belgrade, Republic of Serbia
bojan.tomic@fon.bg.ac.rs

Abstract – In order to be effective, programmers need to master both theory and practical skills. The key for acquiring good programming skills is the active work: probing code examples, solving problems, doing assignments, developing programs, etc. Unfortunately, many educational materials do not promote active learning: the code must first be retyped or copied before it can be executed, the solution cannot be validated without manual testing or the involvement of teachers and colleagues, the materials cannot be easily distributed and updated, etc. The approach presented in this paper advocates using executable Java and R projects organized as Git code repositories (hosted on GitHub) as means of encouraging active learning. Executable solutions are provided within each project and, in the case of Java assignments, automated JUnit tests are also present so students can receive immediate feedback on the correctness of their solution. The approach had been implemented and evaluated in two programming courses, and the results suggest that students have a very positive attitude towards the use of such materials. The teachers' experiences show that, once implemented, the approach offers many benefits in terms of collaborative making of materials, their distribution and maintenance.

I. Introduction

It is known that programming is best learned through active work. Unfortunately, it often happens that learning materials do not encourage active learning, and can even introduce certain obstacles. For instance, code examples from printed materials must first be retyped so they can be tried out (executed) in a development environment. It's not much different with materials in inadequate electronic formats (like video tutorials, presentation slides, screen-shots with code, PDF files, etc.) because the code must again be retyped or copied with many changes. In addition, it often happens that solutions are not provided with the assignments or that only one variant of the solution is present. The solution made by the student must then be identical (or very similar) to the presented one, so that he/she can (visually) check if it is correct. In all other cases, the student must test his/her own solution or ask colleagues or teachers for help.

The problem lies also in the way in which the materials are created, distributed and updated. Teachers can collaborate effectively with each other when creating course materials with the use of tools like Google Docs and Microsoft Office 365, but these tools are not suited for programming examples and assignments – the code cannot be executed, but only pasted as text. The distribution of course materials can be done by means of a course website, however that requires using different software tools for creating the materials and for creating and updating the website. As far as updates go, changes made to books and workbooks (both paper and electronic ones) must wait for the next edition. Materials published on the website can be updated more frequently, however students need to be notified of the changes each time.

The proposed approach is aimed at encouraging active learning of programming through the introduction of specialized learning materials:

- Using executable programming projects (i.e. Eclipse and RStudio projects) instead of regular course materials: books, workbooks, video tutorials, slide presentations etc.
- Placing executable solutions and, when possible, automated tests (JUnit [11]) within the projects to allow instant feedback.
- Using Git [8] and GitHub1 for creating and publishing code repositories containing these projects, thus making collaborative creation, distribution and updating easier.

II. Related work

Git [8] is one of the most popular free code versioning tools ("Version Control System") that, besides saving project backup and maintaining the

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[1] https://github.com/

project development history, enables collaborative development of a project. Each project is organized as a code repository and can have multiple parallel branches of development. Each code change that is entered into the repository (the so-called "commit") contains information about who made the change, when, and which lines of code have been changed. GitHub is one of the most popular sites for hosting Git repositories on the Internet, and others include: BitBucket, SourceForge, GitLab etc.

Although Git and GitHub were originally intended for commercial software development, their usage in programming courses is becoming more common [3][6][9][13][14]. The results of recent surveys conducted among teachers indicate that Git and GitHub are used either for: publishing and maintaining the course material, and/or for publishing, developing and viewing individual or group student assignments [14]. In one of the studies where Git and GitHub were used to create and view group student assignments, students displayed high enthusiasm because they were working in teams with the support of a professional tool [9]. Less than 5% of students from the study actively worked with GitHub before the assignment [9]. Very poor prior familiarity with GitHub was also noticed in another study [3]. In this study, GitHub was used to publish and maintain course materials as well as to publish and review student assignments, and it was further noticed that students were motivated to contribute to the improvement of teaching materials because they were on GitHub.

Tirkey and Gary [13] suggest that teaching materials, if versioned with Git, need to be stored in “pure” text formats (like XML, MD or JSON). Zagalsky et al. [14] state that the PDF format is often unsuitable for Git due to file size, and the fact that one cannot track file changes. Kelleher [6] provides a procedure for publishing/reviewing student assignments on GitHub.

As the “open data” movement gains traction, scientists are also turning to GitHub to share data and code [15][16]. It is no wonder since data is commonly stored in a platform-independent, textual format – CSV (comma separated values). Although R [2] is not intended for classical programming, it is a very popular language for statistical computing and graphics with professional (but free) development environments like RStudio [3]. The other popular choice is the Python language. And since both R scripts and Python source files are textual, they too are often shared on GitHub together with data. Also, many regular courses and books on statistics and data science, teach the use of GitHub for publishing and distributing data and code or use GitHub to create and distribute course materials [17][18][19].

Automated tests usually aim to check whether the program is doing what is expected. One of the most popular free tools for testing Java programs is JUnit [11]. Asides from automated verification of tests, JUnit also enables "regressive" testing – cumulative execution of all tests (both old and new).

Automated tests are also used in education, although in different ways. In the field of software engineering, the goal is for students to learn to write tests independently, because software testing is viewed as a necessary skill [2][12]. The results of one study suggest that up to 20% increase in the reliability of student programs can be achieved even when students who are still learning programming learn and apply some basic testing techniques and concepts [7]. On the other hand, already-prepared automated tests are often used in education for instant feedback (for students) on the correctness of their solution or for the automatic assessment of their assignments. One study states that the immediate feedback provided by JUnit tests had motivated students to increase the quality of their code [1], while, according to a second study, a similar test system and instant feedback had motivated students to increase the number of attempts to submit the correct solution [10]. The results of another study suggest that immediate verification of the solution (through automated tests) helped students solve the task, while automated grading mostly benefited teachers [5]. Finally, in one of the studies where students were using JUnit tests to obtain feedback, students had developed the view that it was not the teacher who required them to correct the code, but the computer, and the teachers stated that it was much easier to "prove" to the students that their code was not correct [4].

The approach proposed in this paper is characterized by the use of Git and GitHub for publishing, distributing and maintaining course materials. Students do not send their assignments

[2] https://www.r-project.org/about.html

[3] https://www.rstudio.com/

via GitHub, nor do group assignments. JUnit is not used for automated assessment, but only to provide immediate verification of the solution – during class and at home. Partial results in implementing the proposed approach were published in [20].

III. Educational and Research Setting

The approach was implemented in the 2018/19 academic year in two university-level courses: Programming 2 and Intelligent systems. Both courses lasted 13 weeks, and each course involved 1.5 hours of lectures and 1.5 hours of computer labs per week. Programming 2 (P2 onward) is a 2nd year introductory course on object oriented programming where students learn Java and do their assignments in the Eclipse development environment. It is preceded only by one programming course from the first year. Intelligent systems (IS) is a 4th year course on artificial intelligence where R and RStudio are used in the first eight weeks to demonstrate and implement common algorithms for classification, clusterization etc. The final five weeks do not involve R programming. In the 2018/19 academic year 586 students were enrolled in the P2, and 521 were enrolled in the IS course.

The approach was evaluated both by students and by teachers. Two anonymous (student) surveys were conducted for each course: the initial one at the beginning of the semester and the final in the middle of the semester, after the first colloquium. The aim of the initial survey was to gather information on students' previous programming experience, the type of materials they used to learn programming, and how familiar they were with GitHub. The aim of the final survey was to gather students' opinions about the new approach. The teachers' summarized experiences form the second part of the evaluation.

IV. Organization of Course Materials

All P2 materials, other than one workbook with basic examples (which remained in paper form due to legal constraints), were implemented as Eclipse projects, versioned with Git and made publicly available on GitHub[4]. All IS materials regarding R programming were implemented as RStudio projects, versioned with Git and made publicly available on GitHub[5]. Besides being imported directly to Eclipse and RStudio, all materials could be seen directly on GitHub through a web browser or downloaded as ZIP files with source code. The P2[6] and IS[7] course websites only contained the links to new materials, and were used to publish notices.

A. Lectures

Both P2 and IS lectures were held in a regular classroom where teachers created the examples by displaying new concepts directly in code and discussing solutions with students. The teachers did not use slides, key terms were added directly to the code as comments, or were added to the project as MD files. The MD (Markdown) format, both supported by Eclipse and RStudio, enables basic text formatting, the addition of images and links and is easily versioned with Git since it contains only text (in accordance with suggestions from [13]). When the lecture was over (and even during class), students could import the lecture example directly from GitHub into Eclipse/RStudio, and then try it. They could also import the examples from any previous lecture by entering a different link or by loading a previous version of the project.

B. Computer labs

A total of thirteen repositories with lab materials were made for P2 and eight for IS. Every project contained the following: assignment text, data (only for R), JUnit tests (only for Java) and assignment solution. The assignment text was either written as MD (Java) or inserted directly into the script files that students work on during labs (R). The R assignment data was provided as CSV. The solutions were provided after labs as source files (Java) or completed scripts both as source and with R output in PDF (R). As stated, Eclipse projects additionally contain a JAR file (Java archive) with compiled, executable JUnit tests. The test source code was not included in the project, because the project would not compile until both assignments were completed or a "skeleton" for each assignment class and method were created (similar to [4]).

The GitHub repository structures for Java and R projects are presented in Figure 1 and Figure 2 respectively. Each repository has two separate development branches: master and all_materials. The master branch is intended for students to use during labs as it contains a project with the assignment text, assignment data (R only) and the

[4] https://github.com/programiranje2fon/
[5] https://github.com/inteligentni/
[6] http://ai.fon.bg.ac.rs/osnovne/programiranje-2/
[7] http://ai.fon.bg.ac.rs/osnovne/inteligentni-sistemi/

JAR file with tests (Java only). The all_materials branch is intended for teachers so they can prepare the course materials. It hosts a version of the project which contains all the materials from master, but also the solution source code and the test source code (Java only). Teachers can change the materials independently of the ones used during labs, and can transfer the desired changes to the master branch easily. Also, this allows for hiding of the assignment solution until the end of class, as well as making on-the-go changes if necessary.

At the beginning of each labs, both students and teachers imported the master branch project directly from GitHub into Eclipse/RStudio. During P2 labs students could verify their solutions by running JUnit tests on the classes, attributes and methods they finished. When the labs ended, the teacher would copy the solution from the all_materials branch to the master branch making it available to everyone.

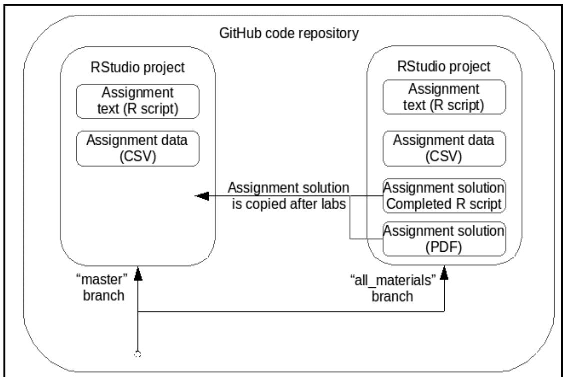

Figure 1. GitHub repository structure for R projects

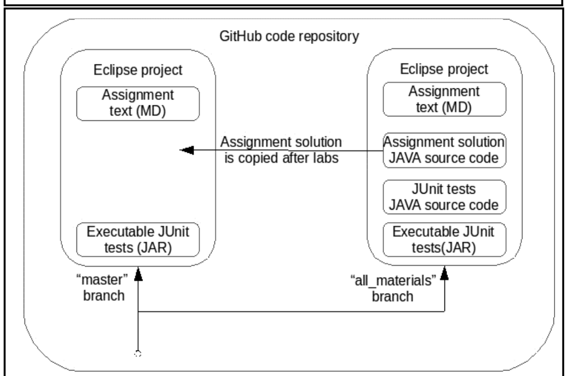

Figure 2. GitHub repository structure for Java projects

C. *Exam preparation materials*

Repositories containing colloquium and exam preparation assignments have the same structure as the repositories with lab materials, but the solution is given in a separate text file right away. That way, students could start working on their solution immediately after importing the project and, when necessary, look at the provided solution or run tests.

V. RESULTS

A. *Initial survey*

The initial survey was conducted during the first class; 277 2nd year P2 students (47.27%) and 168 4th year IS students (32.24%) responded. Most of the surveyed P2 students (206 or 74.4%) had not yet passed the programming course preceding P2. Most of the IS students (128 or 76.19%) had passed all programming and statistical courses preceding IS.

When P2 students were surveyed whether they learned programming before the faculty, 46.57% stated that they learned programming in high school, 4.33% said that they learned programming themselves, 8.3% learned both in high school and themselves, while 40.79% stated that they did not learn programming before the faculty (for more details, see [20]). IS students were surveyed on their previous elective programming and statistical courses, and 61.9% stated that they did not take any electives while the remaining 38.1% stated they did.

As far as concrete programming skills and experiences are concerned (Figure 3), 59.6% of P2 students and 49.4% of IS students know how to type without looking at the keys, and almost none are involved in open-source projects. IS students state to be more experienced than P2 students in terms of developing their own programs and knowing how to use the command line.

The materials that students use for learning also differ (Figure 4). Although both P2 and IS students use workbooks, IS students rely more on books and web-based materials like tutorials, clips, courses, forums and blogs. Unlike P2 students, IS students use open Git repositories for learning. Also, 56.3% of P2 students and 64,3% of IS students stated that the solutions for the assignments were available. If the solutions were not available, the students tried to test their solution themselves (50.8% of P2 and 70.8% of IS students), consulted with colleagues (48.1% P2; 54.2% IS) or asked in online forums and social media groups (25.9% P2; 44.6% IS). Very few stated that they asked the teacher during class (10.2% P2; 8.3% IS) or during open hours (6% P2; 11.9% IS), or that they did not test the solution at all (12.4% P2; 11.9% IS).

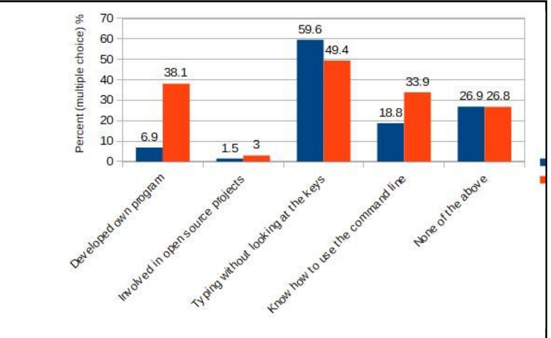

Figure 3. Students' programming experiences/skills

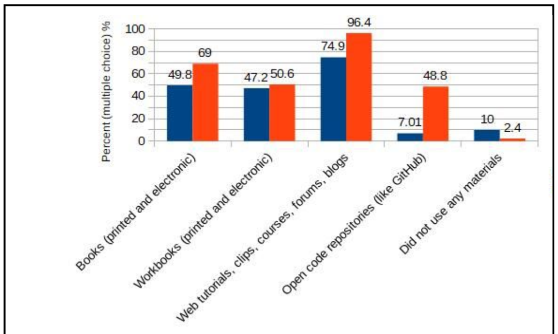

Figure 4. Types of materials used for learning programming

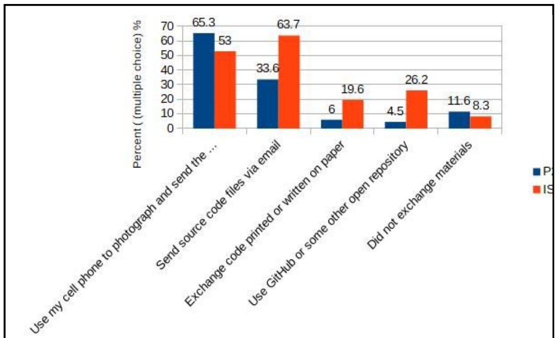

Figure 5. The way students exchange code examples and

The way that students exchange code examples and solutions also differs (Figure 5). Although many use cell phones to photograph and send the code (65.3% P2; 53% IS), IS students send source code files via email more frequently than P2 students, and tend to utilize GitHub and printed/written code as means for exchanging solutions more frequently.P2 and IS students' experiences regarding previous GitHub usage differ significantly. Whereas most P2 students have not heard of GitHub (54.5%) or have heard of it but do not know what it is for (20.9%), IS students state the opposite: 39.9% know what GitHub is for, but have not used it, 24.4% have used GitHub for downloading content and 22.6% have their GitHub accounts and projects.

B. Final survey

The final survey was conducted mid-semester; 263 P2 students (44.88%) and 42 IS students (8%) responded. The response rate for IS students was very low due to low class attendance, and the survey could not be repeated successfully in the following weeks. Some of the students' experiences regarding Github usage are summarized in Table 1.

Most students stated that they imported the projects directly from GitHub into Eclipse and RStudio (89.7% P2; 52.4% IS), and 35.7% of IS students preferred to download the projects as ZIP files and open them later in RStudio. Most students did not have any problems in accessing the materials (98.5% P2; 90.5% IS). Also, when asked if they would prefer the course materials to be distributed by other means (other than GitHub), most students responded that they think GitHub is the best (80.2% P2; 78.6% IS), while a minority preferred electronic books and workbooks (7.6% P2; 16.7% IS).

When asked if the availability of course materials in the form of concrete projects on GitHub influenced their motivation for programming, 64.6% of P2 students and 38.1% of IS students responded that their motivation increased, while the rest (35.4% P2; 61.9% IS) claimed that it made no difference. Finally, when asked if the availability of an assignment (project) that can be directly imported into Eclipse/RStudio influenced their motivation to complete the assignment, 66.9% of P2 students and 47.6% of IS students responded that their motivation increased, while the rest (33.1% P2; 52.4% IS) claimed that it made no difference.

TABLE I. STUDENTS' EXPERIENCES REGARDING GITHUB USAGE

	How often did you use the lab materials (GitHub projects) at home? (1–Not at all; 5–Regularly)				
	1	2	3	4	5
P2	4.6%	6.8%	14.8%	21.3%	52.5%
IS	4.8%	4.8%	4.8%	16.7%	69%
	How often did you use the lecture materials (GitHub projects) at home? (1–Not at all; 5–Regularly)				
	1	2	3	4	5
P2	58.6%	20.9%	9.1%	4.9%	6.5%
IS	57.1%	14.3%	9.5%	2.4%	16.7%
	How often did you use the exam preparation materials (GitHub projects) at home? (1–Not at all; 5–I practiced all of them)				
	1	2	3	4	5
P2	3%	3.8%	12.2%	16.7%	64.3%
IS	11.9%	11.9%	4.8%	23.8%	47.6%
	To what extent do you find GitHub suitable for distributing course materials? (1–Not at all suitable; 5–Absolutely suitable)				
	1	2	3	4	5
P2	0.4%	0.8%	8%	14.4%	76.4%
IS	7.1%	0%	4.8%	19%	69%

P2 students' experiences regarding JUnit test usage are given in Table 2. In addition, 80.2% P2 students stated that they did not have any problems when using JUnit tests, while the most common reported problems are: tests report an error while the code seems to be correct (5.32%), tests are too rigid in terms of a full match with the class name, attribute, methods and expected output (4.56%), test message was unclear (3.42%) and that the tests would not run (1.9%). Finally, 79.5% of P2 students stated that they would like to have JUnit tests during the exam so they could verify their solution.

C. *Teachers' opinions and experiences*

Five teachers involved in the two courses (for more details, see [20]) stated that it took some time and effort to learn Git, to prepare the materials in a suitable format and make everything available on GitHub. Fortunately, the (technical) distribution of work with Git and GitHub was easy. Many Java and R development tools have built-in support for MD, JUnit, Git, and GitHub so everything could be done using a single environment. Once everything was set, commenting, editing, and updating the materials was simple. Finally, there always existed several backups so the materials could not be lost or erased.

However, GitHub implies the public availability of all repositories created with free accounts. Academic licenses and alternative hosting sites are available, but configuring access for many students to a private repository is hard. Alternatively, it is possible to put Git repositories on network drives, thus limiting their availability only to LAN users.

TABLE II. P2 STUDENTS' EXPERIENCES ON JUNIT USAGE

To what extent did you use JUnit tests to test your lab assignment solution during class? (1–Never; 5–Always)				
1	2	3	4	5
7,6%	8%	12.2%	19.8%	52.5%
To what extent did you use JUnit tests to test your lab assignment solution at home? (1–Never; 5–Always)				
1	2	3	4	5
16%	14.8%	17.5%	15.2%	36.5%
To what extent did you use JUnit tests to test your exam preparation assignment solution at home? (1–Never; 5–Always)				
1	2	3	4	5
15.2%	9.5%	16.7%	15.2%	43.3%
Your opinion on the usefulness of JUnit tests for lab assignments? (1-Not at all useful at all; 5-Extremely useful)				
1	2	3	4	5
2.7%	5.3%	17.9%	28.1%	46%
Your opinion on the usefulness of JUnit tests for exam preparation assignments? (1-Not at all useful at all; 5-Extremely useful)				
1	2	3	4	5
3.4%.	3%	18.6%	25.1%	49.8%
How often did you happen to think that your solution is correct, but then the JUnit tests show you it is not correct? (1-Never; 5-Very often)				
1	2	3	4	5
6.1%	13.7%	38.4%	28.1%	13.7%

VI. CONCLUSION

Students have a very positive attitude towards the proposed approach, especially for the use of GitHub in distributing the materials and state that they prefer it over other means. They clearly exhibit active learning since they regularly import and use (mostly without issues) the projects and the automated JUnit tests within. They consider JUnit tests to be useful during labs and for preparing for the exam, and would like to have similar tests available to them during the exam. Second year students seem to be more motivated than 4th year students to finish the assignments and to do programming because of the way materials are organized (projects on GitHub). Teachers' experiences are also very positive and, with the exception of the initial effort to learn Git and reorganize the materials, the introduction of this approach reduces subsequent maintenance efforts.

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Computer Support in Graphic Educational Subjects

M. Klekovska*, C. Martinovska Bande**
* FON Univerzitet, Skopje, R. North Macedonia
** Computer Science Faculty, Univerzitet Goce Delcev, Stip, R. North Macedonia
mimiklek@yahoo.com, cveta.martinovska@ugd.edu.mk

Abstract - This paper provides an overview of some problems in acquiring graphic engineering education, as well as a proposal for the application of algorithms and software applications in explaining graphic tasks, especially in the field of descriptive geometry in 2D and 3D modeling. The acquisition of this knowledge can hardly be accomplished by self-studying or only through learning theory, without practical exercises. Even if the student has answered, solved tasks in front of him, if the sequences in the procedure of resolving are not known, he/she can not solve the homework. Sometimes there is a demand that the sequence of steps for some students should be repeated for a second or third time. The comprehension and idea of spatiality, even when working only with 2D figures, is more effective by using visualization and animation in the course of explaining the resolution process. This increases the discipline, dynamism and rhythm that need to be absorbed in order to achieve success. Consistency of the graphic expression is also a significant precondition for good engineering education. The coloring and gradation of lines in computer animations is more striking/impressively and gives greater expression to the student population.

I. Introduction

When talking about quality of education in abstract terms, in the most general sense and in its highest emanation, regardless of the subject matter, it is instructive to remember the words of Tagore, who said: "The best education is not the one that the information itself gives us, but the one what our life associates with its entire existence." Education is a mental process and if every mental task is conceived as a pain, the thought is the medication. [7]. Thought causes emotions, and emotion activates the spirit, and it even causes a physical feeling.

The Ancient Greeks considered the educational process as an active act of the student who should activate his spirit HERE and NOW if he wants to learn something. Contrary to this understanding, the Middle Ages puts students in the role of a passive audience, who can, but do not have to do so much while the teacher speaks. The role of the teacher is that of a preacher who should convince the student of the truthfulness of his words.

Modern definitions describe learning as a complex psychic process that should lead to a change in the behavior of the individual, based on the acquired knowledge and experience. It does not only presuppose a set of information, but also encompasses the adoption of habits, skills, and abilities that are stored in the memory stack. In the process of learning, knowledge and memory are two aspects that complement each other.

Intelligence is also a clue that leads to success in education, but not as a measure of how smart a person is, but in what way. Every human being has his/her own repertoire of skills. Professor Gardner of Harvard University developed the "Theory of Multistage Intelligence". According to this theory, one of eight types of intelligence can prevail among students: linguistic, logical-mathematical, visual-spatial, music, bodily-kinesthetic, interpersonal, intrapersonal or natural.

Traditionally, school subjects that are taught demand mostly linguistic and logical-mathematical intelligence, and the students with this kind of abilities do best in the school system.

Today's state of education in our country is fairly traditional, and it is closer to the medieval than to the ancient Greek model of learning, although history has shown the former to be a less effective model.

In order to encourage students' interest with today's methods, teachers turn the lecture into a show, using slides and presentations to keep the attention of the student, who still has the freedom to stay passive.

Each school subject has its own specificity, and teachers, following the interests of the students, try to approach and adapt the subject matter to their interests, without undermining the old educational values.

Today's era is an era of informatics, and computer science is a tool that can be used creatively to help us find a balance in the application of new technologies and old methods. Informatics gives students the opportunity to turn PASSIVE audiences into an ACTIVE actors, who will decide how to navigate through the process of acquiring knowledge by interacting with computer applications.

II. THEORETICAL CONSIDERATIONS FOR KNOWLEDGE TRANSFER

A. Choosing a tutorial

Taking into account the proverb: 1 picture = 1000 words, and the fact that pictures cannot keep the student's attention long enough, it is necessary to update the words and images with new media: animations, videos, interaction. Moving images tickle the visions of the viewer, leave a greater impression, and are more likely to stir up emotion. Emotions leave a deeper trace and take longer to remember. In some languages, the root of the word emotion is the word motion (motion-emotion).

Engineering knowledge, especially if it is related to geometry and spatial representations, simply cannot be presented descriptively, with words alone. Language intelligence is not very helpful in this case. Even a final drawing with a given solution does not lead to an idea of how the task should be solved, because it does not show the movement and the sequence of steps. Therefore, an animated simulation of the process with all the stages of line drawing will have a much better effect than words and static drawings.

The application of animations and videos in lectures improves explanation. The first step, in the form of TUTORIAL, still leaves the student in the role of audience in the performance of acquiring knowledge. The second step, when a student is asked to solve a school task, should make him an active actor in solving it.

This is not a type of task requiring a flash response, like a test question that requires the student to circle the correct answer, but a procedure with a strict sequence of steps.

According to all theories of learning, successful, independent completion of the task can happen only if students were active previously (sensory, practical, expressive, thoughtful). Constant exercise/drawing over time causes multiple changes in the students' mind.

The way of thinking and understanding spatiality of different positions/coordinates (transformative theory) changes.

It changes the manner/skills/use of geometric tools (behavioral theory).

Students are able to imagine new and more complex geometric shapes, which are upgraded/ deposited on previous simpler forms (constructivist theory).

The learned/imagined material remains imprinted in the memory of the student as a seal (cognitive theory).

For that purpose, it is useful to upgrade classic graphic software applications like AUTO CAD, with a software connection and interactive modules allowing students to navigate through different types of required graphic activities for representation of lines, planes, 3D representation, curved lines, spheres, etc. In this way, the process of learning and testing knowledge acquired is much more efficient, both for the student and for the teacher.

B. Previous knowledge and habits

The syllabi in our country do not include graphic education of the Descriptive Geometry. The basic concepts of constructing polygons are studied in primary school, while secondary schools, with rare exceptions of classes in gymnasiums/ (mathematics classes) and specialized secondary civil construction schools, do not include such an subject at all. The Faculty of Mathematics also does not pay much attention to draft geometry.

If Plato's condition "Let None but Geometers Enter Here", [5] were true today, only a few persons would gain access. Through geometry, the skills for spatial understanding and visualization are practiced, which practically develops intelligence, its third form. [2]

Apart from linguistic and logical-mathematical intelligence, which are on the top in the ranking list, visual-spatial intelligence as the ability to think in pictures and visualize the future outcome and to imagine things in the mind, is the next, third, highly ranked piece of overall intelligence. [3].

Very often, almost regularly, mathematics is ranged as the most "difficult" subject.

An additional difficulty in geometry is that besides studying the rules, it is necessary to have appropriate accessories (linear, hexagonal, etc.) and concentration to imagine the rhythm as the kit is used.

Independently, individual learning "from a lecture book" does not give satisfactory results. It requires active work with a coach. Only engaging attendance, tracking and repeating the rhythm and direction of the movements can lead to a successful completion to the task. Otherwise, the basic law of clarity and visualization is violated, motivation decreases, persistence, decisiveness and faith are lost. This is reflected in the self-confidence of the students and their faith in the skills of the teacher Every student, when faced with something he/she does not understand, skips over it or gives up.

C. Example of a task

For example, the task of solving roofs is pointed out. (Fig.1) It provides a descriptive, two-dimensional view "from above" of a house with a broken ground. [4] The basic task, the numerical measurements (Fig.2) and the solution (Fig.3) with clarification (Fig.4) are graphically presented with illustrations. The numerical dimensions are given as help in laying the foundation, because of the ingrained habit to think through numbers.

(6,5) = 8 cm

(5,4) = 5 cm
(3,4) = 7 cm
(← 6) = 4 cm
α(2 to the right) = 60^{O}, α(2 to the left) = 30^{O}
α (6 from outside) = 60^{O}

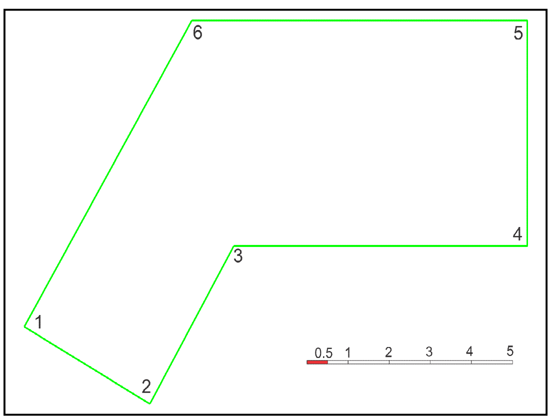

Fig.1 Setting the task

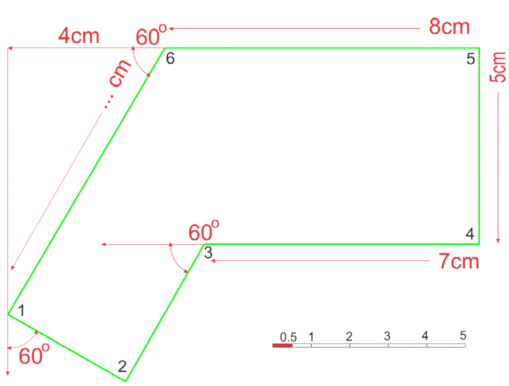

Fig.2 Help in setting the task

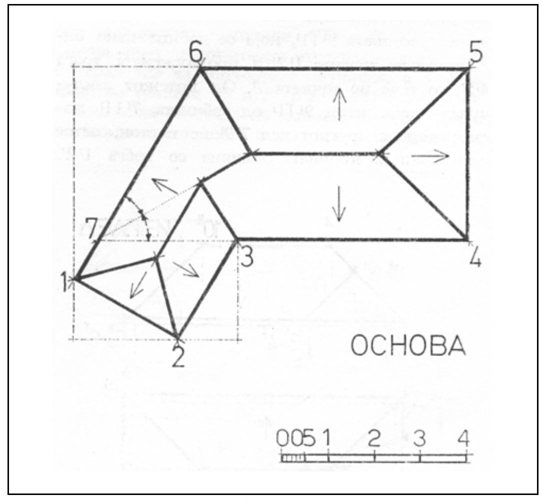

Fig.3 Solution to the task

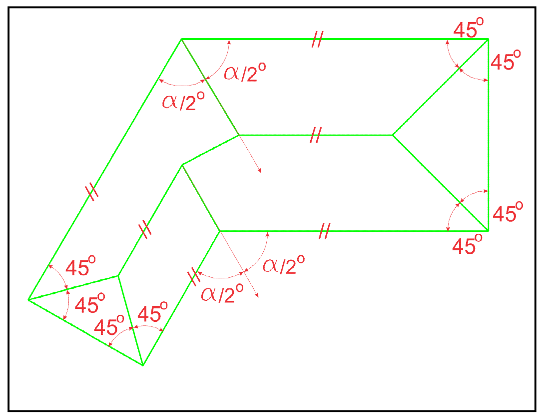

Fig.4 Help in solving the task

The illustrations do not guarantee that the task can be solved or successfully copied.

The idea in setting this task is to give only the most necessary measures needed for the unequivocal construction of a single solution without variants of diversity. The geometric, constructive way of thinking and graphic language of mutual understanding are also enforced. Because of this: the scale is graphically set, the dimensions should be visually recognizable (graphic, with the shingles) , and the construction angles can be easily found from a standard set of triangles.

A properly assigned task is a good basis for a successful solution. A badly assigned task is sometimes the source of many problems. Notwithstanding, , the next step is to solve the task. The solution consists of pulling out several lines that will give the required image. At first, a helpful image of what the final version should look like is given. It is not always helpful enough.

A second, improved variant of the initial static images that can be provided is the orderly display of the choice of directions and the lines that make up the drawing.

However, the animated presentation of the solution is more illustrative.

If the success of the display is measured by memory or the longevity of the observer's memory of what is seen than the animated display and the video material will stay longer in the observer's memory.

Moreover, in this way it will be possible to get the autonomous repetition of the task-solving process. The memory of the "driving sequence" stimulates the imagination and gives greater courage for independent action not only in the same, but also in similar situations. [6] It affects the overall perception, the experience of identity creation, and the imaginative memory of what was seen in the observers' memory.

III. PRACTICAL TEACHING

A. Methods of lectures/exercises

Material stored in electronic form as a set of static images, animations and videos are the most sought after forms of materials (scripts) for preparation/learning. The exchange of the materials is electronic, of course. The current F generation (Facebook generation) no longer has the patience of the previous G, X, Y, BB generations (G = Game, BB = baby boom), and even classical e-mail is a long procedure for a growing number of students.

In particular for the subject Descriptive Geometry, the requirement is that the drawings are NOT drawn by computer. Computers can be used to help in all variants, but the solution is passed on to the hammer in pencil form. This insistence /requirement on drawings to be made MANUALLY, rather than by a computer, drastically changes the situation and imposes a more active engagement and focus during class. Everyone decides how and the extent to which they will use modern technologies to solve the task. There is a possibility to do so, in four different ways.

The first method of static images (assigned and completed) (Enclosure: a sequence of static images) is sufficient only for a small part of the students. Most of them have many doubts about the activities that should be done in the meantime, especially students who do not have a solid previous background.

The second method of animation (Enclosure: animation) eliminates many doubts, clearly defines the starting positions, the course and the goal to be achieved, but some steps can still be unclear for some students with insufficient prior preparation and knowledge they should have acquired in basic geometry classes. They also lack the skills for handling geometric drawing tools.

The third method, video material (Enclosure: video material), if followed closely and with focus, should not leave any step unclear. It is a question of time, patience and good will whether the expectations will be met.

The fourth method of direct, live consultations (Enclosure: class attendance) is, of course, the fastest and most comprehensive method for those who favor active participation.

B. Investment

In comparison with other school subjects, Design Geometry students quickly recognize the need for their own active engagement, so attendance and active participation in these classes is high. It becomes clear that the Chinese proverb is quite correct: "The teacher can open the door, but the student must pass through it himself."

Students and affinities differ. It is up to the students to decide how proactive they will be, how much time and effort they will want to invest in the subject matter, and how they will apply the laws of learning: the law of belief, the law of hard work, the law of persistence, the law of power and energy, the law of integrity in work, the law of learning step by step, the law of understanding and linking the construction, the law of decisiveness, the law of planning and preparation, the law of motivation, the law of learning from general to individual, the law of remembering key information, the law of clarity, the law of priority, the law of consistency, the law on visualization of the learning material, the law for testing knowledge, the law for analysis and checking the learned. [1].

There are instances of a student showing self-initiative to attend classes with the next generation, if in his generation he failed to pass the subject.

C. Results

In general, the average grade in the subject Descriptive Geometry is lower compared to many other subjects in the educational process. What is positive about these classes is the interaction, mutual assistance, live co-operation, and productive noise generated among students.

Individual attitudes and persistence to overcome the problem can be quickly observed.

Here, every theory of learning can be applied: behavioral, cognitive, constructive, and transformative. ([8], [9]). Initially, signs of frustration and nervousness are displayed, when something fails, but also pleasure and pride when the problem is solved.

IV. CONCLUSION

In contrast to teaching subjects where the presentation of the theoretical aspects of learning process is basic, and the practical exercises are less demanding and can be carried out through discussion, graphic school subjects (among which Draft Geometry) in addition to knowledge, require mastering a set of skills, which in turn requires greater investment of energy, both from the teaching staff and the students.

The content of the material in this subject over time does not change much. The same knowledge should be conveyed to each new generation, but new ways of transferring knowledge should be sought, adapted to reach new generations. The success level of this course does not have to measure up to that in other subjects, and this is usually the case. But, there are cases, albeit rare, of excellent success demonstrated by withdrawn, introverted students with average language ability.

There is the greater sincerity, and less possibility for cheating and inconsistencies when testing acquired knowledge. The nature of the subject allows for application of the old postulates of ACTIVE spirit, and leaves plenty of opportunities for the application of new high-top graphic technologies in teaching.

The approach, presentation, and way of sharing materials also leaves great freedom and opportunity for applying various creative methods that will resonate, above all, among the younger generations. The example in the paper concerns and stops at 2D presentations. It can of course be upgraded into a spatial 3D task.

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Virtual Training Space

B. Sobota, Š. Korečko, M. Hudák, J. Ľonc
Department of Computers and Informatics, Faculty of Electrical Engineering and Informatics,
Technical University of Košice, Slovak Republic
branislav.sobota@tuke.sk, stefan.korecko@tuke.sk, marian.hudak.2@tuke.sk, jakub.lonc@student.tuke.sk

Abstract - The work described in this paper is about training of job candidates in collaborated company, whose main activity is the electricity distribution to the end customer in the area of Eastern Slovakia. Primary, it is software running on PC or mobile devices allowing employees to get first-hand experience in virtual environment and, of course, in working environment without risk of injury by high voltage. It's first basic step for developing this type of software in collaborated company. There are described existing solutions and finding from world of virtual reality. Based on this solution is possible to develop also a training space for handicapped people.

I. INTRODUCTION

New technologies in training and education process including virtual reality **Error! Reference source not found.** are very important either as tools or as study subject. At DCI FEEI TU of Košice we focus to both ways. Our LIRKIS laboratory (Laboratory of Intelligent inteRfaces of Communication and Information Systems) is the excellent laboratory for research, development and teaching applications in area of parallel, distributed and network computing systems for solving computational processes in the processing of graphics data and virtual reality with a primary focus on information systems and visualization, intelligent interfaces and human-computer interaction. Virtual reality and its technologies is very usable in mentioned education and training process. In collaboration with our industrial partner is developed a prototype of training system. It took about two years. The prototype is developed as "game-based" system in VR environment. It is able to work on 3 levels.

The 1st level is a "movie-based" training, where we can create animated instructional videos in a virtual environment. The 2nd level is a true "game-based" training system. It is created using the Unreal game engine actually. The virtual environment consists of some power plant buildings with rooms, where the user (trainee) has to solve some tasks. For example, to get a safety helmet, connect a door to ground, inspect some devices visually or turn off a switch. After successfully solving one task the player proceeds to the next one. The rooms and tasks are prepared by an instructor. The environment can be used on a standard PC, a laptop or a smartphone. It can be displayed on a standard display or via a VR headset (3D helmet). We also work on the modification of environment for a VR CAVE **Error! Reference source not found.**. This level is in beta-phase. The 3rd level is a usage of mixed reality, based on mixed reality glasses or helmet including interactive manipulation with virtual objects **Error! Reference source not found.**. This is the last level, which is still under development. We plan to use MS Hololens or a similar device as the glasses. As the first step we will create a simple mixed environment with holographic objects. The trainee will have to reorganize prepared objects to correct position, orientation or order. The next step will be training with these holographic objects in a real environment of a power plant. Another, experimental, step should be utilization of a virtual environment, provided by the CAVE, and a mixed reality object (mixed reality in virtual reality).

The aim of this paper is description of the first step of this system. Virtual training space system will be used to train newly recruited employees for work in very dangerous conditions. The biggest benefit of this solution is risk reduction of injury by high voltage and increasing the imagination of the main idea of the work for employees. Purpose of this work is to get familiar with process how to develop this type of software. There are described the most important steps that must be done and mistakes that you need to pay attention on. Vision is to create system that will be connected with devices supporting augmented reality like Microsoft HoloLens (3rd level). Then the training process will be possible to start in every empty space (room), because all devices will be placed in virtual environment and trained employee must in correct order perform the manipulation on this device. By inserting physical movement can company increase efficiency and quality of training process what is the purpose of this whole project.

II. SOLUTION DESIGN

Based on the analysis was selected for development free and open source software Blender. It supports modeling, rigging, rendering, animation, compositing, video editing and even game creation. It runs on all platforms equally well. For creating virtual reality experience was selected Trinus. This software can share screen from computer to mobile device and create layout on mobile screen for VR headset. It means that everything what is displayed on computer screen can user see in headset and by head movement can control mouse cursor. Use-case diagram of solution design is illustrated in Figure 1

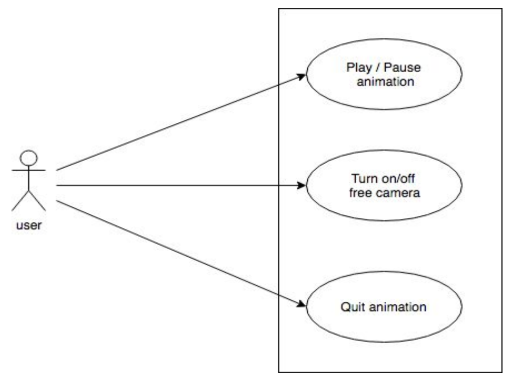


Figure 1. Use-case diagram of solution design

Part of solution design is get familiar with individual steps of development process. First of all is to run Blender software and if there are not available objects is necessary to create them with first step – Modeling. Part of modeling is apply to objects texture for realistic look. For ensure dynamic rendering of activity process is necessary creates animations for objects which will be played and controlled by user in game engine. Controlling animations and camera movement is creates via scripting language Python. Last step in developing part is to export runnable file for each platform. This process is illustrated in Figure 2

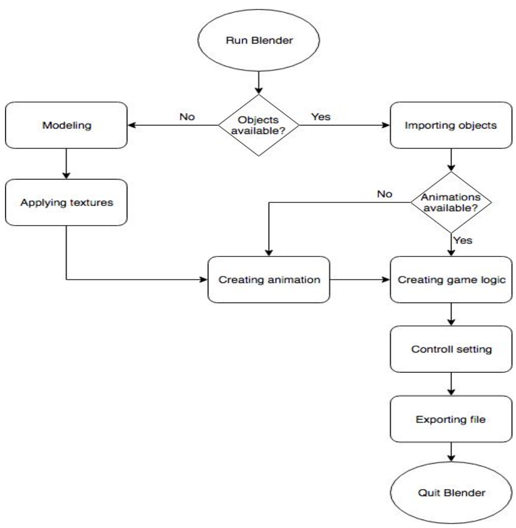


Figure 2. Flow diagram for development process

III. IMPLEMENTATION

The most important and also the longest part of this work is the implementation of solution design for training staff in electricity distribution domain. In development process are three the most important points: Modeling, Animation and Game Engine.

Modeling is creating 3D objects like body of employee, working rooms and devices that are used for manipulation. To increase realistic look of objects are very useful materials from company like pictures and technical documentation of devices in working room that can be added to Blender like is illustrated in Figure 3Objects that are complicated and movable needs to have rigging adding controls to object. This will be useful in animation part for making more realistic movement of objects like human.

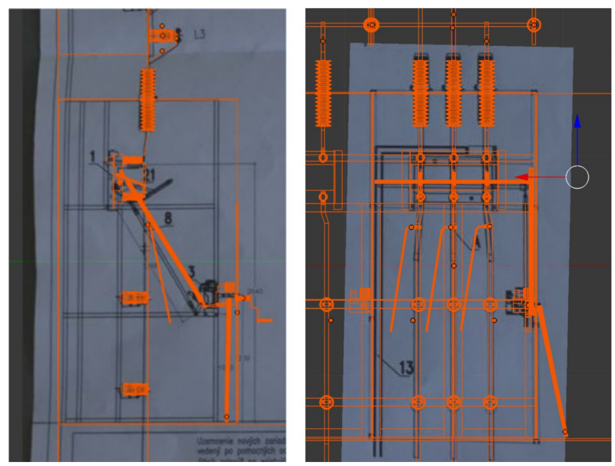


Figure 3. *Object modeling with picture in background*

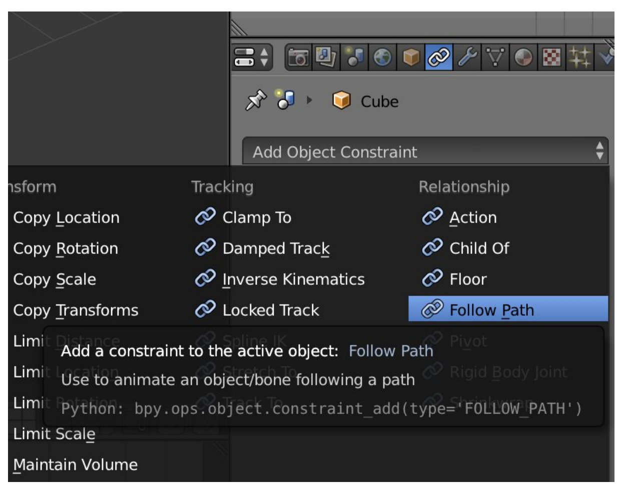


Figure 4. Adding object contraint Follow Path

Next point is animation creation. Blender use for this f-curves which creates interpolation between individual key-frames. This is causing that is not necessary to set every key-frame manually in simple object animation. Useful feature in Blender is follow the path object constraint (Figure 4) that make object following the created path and when is created also animation cycle of walking body it can be easy connected together which will create good looking walking body animation.

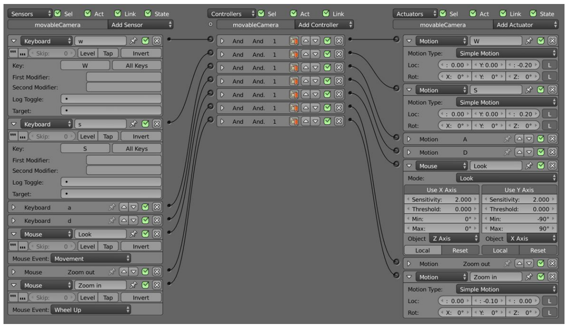
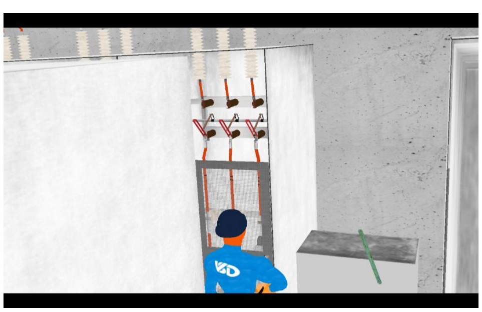


Figure 5. Camera movement settings in Logic Editor

Third important point is Game Engine (in Blender it is Blender Game Engine – BGE. Future step is e.g. Unreal Engine or Unity implementation). It is very important because in this point it is being created system connection with user. It means that user can control free camera movement for example or play/pause animation. Simple object movement controls can be set via Blender user interface in Logic Editor (camera movement in Figure 5) but for more complicated controlling is necessary to write Python scripts.

The final visualization is illustrated in following figures. 0illustrates 3^{rd} person view during a manipulation with device. The same situation is in Figure 6In this case it is from worker view (1^{st} person view). The last example is in Figure 7In this case is used free camera with possibility of controlling in real-time by using e.g. mouse, keyboard or other tracking devices. These possibilities are more advanced as training video watching.



3^{rd} person view

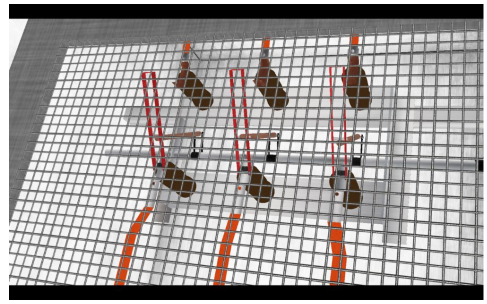


Figure 6. 1st person view

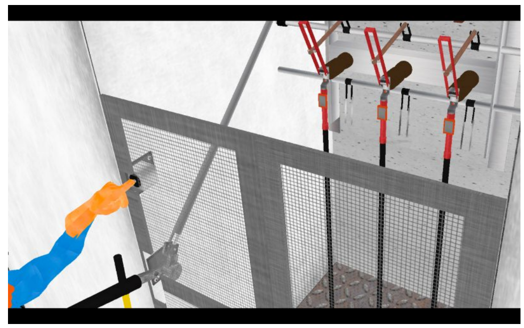


Figure 7. Free-camera view

IV. Adaptation for Handicapped People

Handicapped people are not only users with physical or sensory disabilities but also cognitively impaired ones (e.g. users with learning disabilities or concentration problems). 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. Some experimental experiences of our team were obtained in cooperation with Pavol Sabadoš special boarding school in Prešov. This school is special school for handicapped children.

Based on previous described system it is possible to create interactive VR system for increase of their social skills (e.g. behavior in a restaurant or in an airport). Next level is enhancement of their abilities in difficult conditions (e.g. wheelchair movement into lift). And also disabled people need to use supporting technologies to work with computers. For rehabilitation and training of disabled persons a utilization of augmented reality (AR) technologies seems to be very promising. 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 (2nd level of our developed system). The utilization of AR for the rehabilitation can be in a form of a “virtual training table” device. For example, 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 virtual object (Formally, it is the same process as worker action in power plant in the previous described case). 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.

V. Conclusion

This work is about to get a look into VR world and get familiar with basic development process for creating this type of software. System in this state unlike the current one used in company has benefits like the ability to watch manipulation from angles and locations that are not possible to movie from in real life whether it is because in terms of security or physical possibilities (for example walls in room). Next benefit is meanwhile animation is playing or is stopped user can move around the space/room to take a look from another angle which is also not possible with video animation. The final goal of this level is to advance to the next level (true "game-based" training system). As was mentioned in previous, a beta-phase is under development. The examples of this system is shown in Figure 8

Figure 8. Examples of new generation of training system

VI. Acknowledgement

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Theoretical Basics of Statistics via Examples

M. Kocaleva, L. Loku, B. Zlatanovska, N. Stojkovikj, A. Krstev
Faculty of computer science, "Goce Delcev" University, Stip, Macedonia
mirjana.kocaleva@ugd.edu.mk, linditaloku@outlook.com, biljana.zlatanovska@ugd.edu.mk,
natasa.maksimova@ugd.edu.mk, aleksandar.krstev@ugd.edu.mk

Abstract - Statistics is a branch of mathematics, which deals with all aspects of data. In data analysis are primarily used two main statistical methods: descriptive statistics and inferential statistics. In our research the focus in on descriptive statistics. From descriptive statistics we are considering mean, mode, median, quartiles, variance and standard deviation, outlier, rang, boxplot, scatterplot, steam and leaf plot, mean deviation and mean absolute deviation. The methods listed above are presented through examples.

I. INTRODUCTION

Statistics is a very broad subject, with applications in a vast number of di• erent fields. Statistics is the methodology for collecting, analyzing, interpreting and drawing conclusions from information. With other words, we can also say that statistics are tools and concepts that are used to analyze data and make decisions from the same data.

Now the question is what data is, what information is. Data is raw, unorganized facts that need to be processed. Data is meaningless and useless until it is organized. Data contains numbers, image, symbols, characters… When data is processed, organized, structured or presented in a given context that make it useful and meaningful, it is called information (Figure 1) [1], [6], [7], [8], [9].

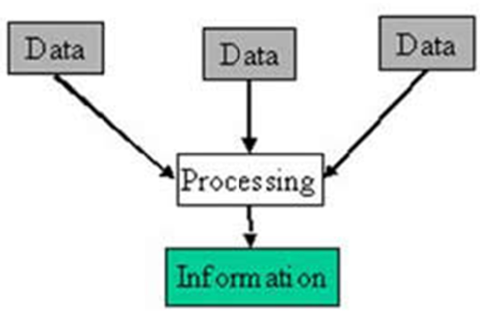

Figure 1 Data vs. information

Data can be quantitative or qualitative. Quantitative data are measures of values or counts and are expressed as numbers. Quantitative data are data about numeric variables (e.g. how many; how much; or how often). (Figure 2)

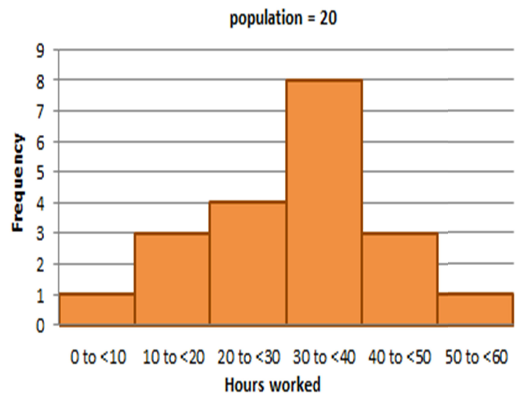

Figure 2 Frequency count of hours worked per week

Qualitative data are measures of 'types' and may be represented by a name, symbol, or a number code. Qualitative data are data about categorical variables (e.g. what type). (Figure 3)

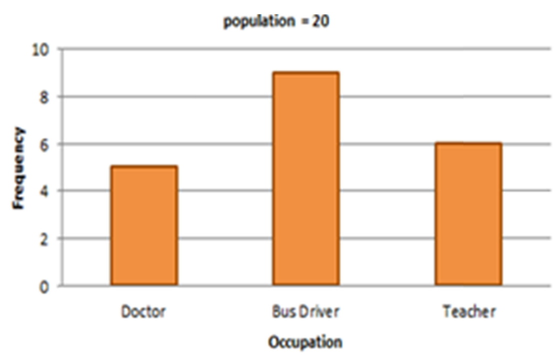

Figure 3 Frequency count of occupation

A variable or data item is any characteristics, number, or quantity that can be measured or counted. It is called a variable because the value may vary between data units in a population, and may change in value over time. Examples of variables are Age, business income and expenses, country of birth, eye color... Variable is called a continuous variable If can take on any value between two specified values; otherwise, it is called a discrete variable.

A. Data Measurement

Another concept that relates to data is levels of measurement [9], [10], [11]. There are typically four levels of measurement (Figure 4):

- Nominal
- Ordinal
- Interval
- Ratio

In nominal measurement, the numerical values means uniquely of the attribute. For example, the numbers in football are measures at the nominal level. A player with number 9 is not more of anything than a player with number 12, they are the same and unique.

In ordinal measurement, the attributes are rank-ordered and distances between attributes do not have any meaning. For example, on a survey if we have 1=completely agree; 2=partially agree; 3=Neutral; 4=disagree; 5=completely disagree. In this measure, higher numbers mean more agreement.

In interval measurement, the distance between attributes does have meaning. For example, when we measure temperature (in Fahrenheit), the distance from 40-50 is same as distance from 70-80. The interval between values is interpretable. Nevertheless, in interval measurement ratios do not make any sense – 80 degrees is not twice as hot as 40 degrees (although the attribute value is twice as large).

In ratio measurement, always an absolute zero is meaningful. In researches, most "count" variables are ratio. For example, the number of clients in past three months are ratio, because we can have zero clients and because it is meaningful to say that today we have twice as many clients than in the past three months.

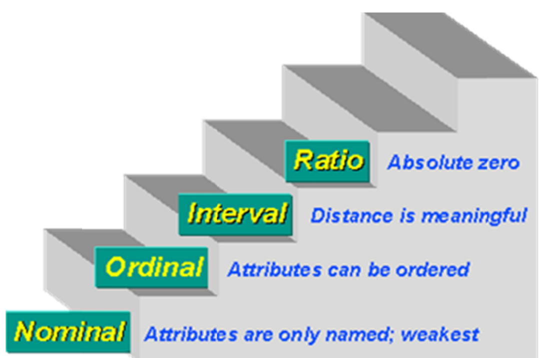

Figure 4 Difference between nominal, ordinal, interval and ratio measurement

II. DESCRIPTIVE STATISTICS

Descriptive statistics are used to describe the basic features of the data in a study (shows what is or what the data presents.). Statistics provide plain resume about the sample and the measures. Together with graphics analysis, they form the basis of virtually every quantitative analysis of data [2], [3].

When we talk about descriptive statistics, we are talking about mode, median, mean, variance and standard deviation, quartiles, outliers, rang, mean deviation and mean absolute deviation… We will present these segments via examples.

In Table 1 is given group of 10 student (4 male and 6 female) and their scores from the first and from the second colloquia from some subject. The subject is not important for the research. The accent is putted on the obtained results [4], [5].

Table 1 Scores from the first and from the second colloquia

students id	*gender*	*scores 1 col*	*scores 2 col*
102000	male	5	15
102001	female	10	15
102003	female	15	8
102004	female	8	6
102005	female	8	7
102006	male	7,5	10
102007	male	12	13
102008	female	19	18
102009	male	2	20
102010	female	0	5

A. Mode

The mode is the most common number in a data set. It is useful in statistics because it can tell us what the most popular item in our set is [12], [13].

A data set can have no mode, one, or many:

- None: 1, 2, 3, 4, 6, 8, 9.
- One mode (unimodal): 1, 2, **3, 3**, 4, 5.
- Two (bimodal): **1, 1**, 2, 3, **4, 4**, 5.
- Three (three modal): **1, 1**, 2, **3, 3**, 4, **5, 5**.
- More than one (two, three or more) = multimodal.

For the example given in Table 1 the mode for the first colloquia is 8 and for the second is 15.

We can also detect the mode from a histogram that shows frequencies of values. We are looking for the "bump" in the histogram. In the histogram below, the bump is at number 4 (Figure 5).

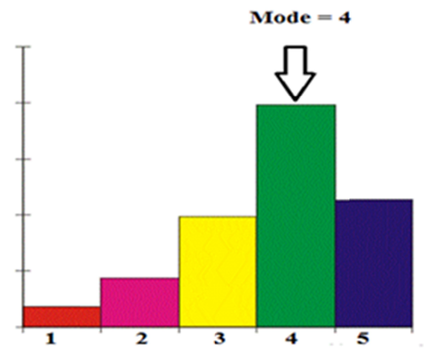

Figure 5 Mode histogram

Mostly on histograms, we can see bars that are groups of numbers. For example, a bar might represent from 10 to 20 or from 30 to 40. The technique is still the same; we are looking for the "bump" in the histogram. In this case, we will have to ballpark where exactly the number is. The easiest way to do that is to figure out where the middle of the highest bar is Figure 6.

Figure 6 Mode histogram

If we have a large number of items in our data set, we can sort the numbers from smallest to largest or largest to smallest in order to find the mode easier.

B. Median

The median is a simple measure of central tendency. To find the median, we arrange the observations in order from smallest to largest value. If there is an odd number of observations, the median is the middle value. If there is an even number of observations, the median is the average of the two middle values [12], [13].

Thus, in a sample of four families, we might want to compute the median annual income. Suppose the incomes are \$50 000 for the first family; \$90 000, for the second; \$30 000, for the third; and \$110 000, for the fourth. First, we ordered those 30 000, 50 000, 90 000 and 110 000. The two middle values are \$50 000 and \$90 000. Therefore, the median annual income is (\$50 000 + \$90 000)/2 or \$70 000.

For the example given in Table 1 the median for the first colloquia is 8 and for the second is 11.5.

C. Arithmetic mean (average)

The arithmetic mean is the sum of all of the data values divided by the number of data values [12], [13].

$$Mean = \frac{\text{Sum of all data values}}{\text{Number of data values}}$$

The equation for the sample arithmetic mean is:

$$\bar{X} = \frac{\sum Xi}{n}$$

When referring to the number of observation in a population, we use uppercase letter.

$$\bar{x} = \frac{\sum xi}{n} = \frac{x1 + x2 + x3 + \cdots + xn}{n}$$

When referring to the number of observation in a sample, we use lower case letter.

Thus, in a sample of seven children, we might want to compute the Grade Point Average. Suppose that the first child has average grade 5; the second 4, the third 3, the fourth 3, the fifth 4.5, the sixth 2 and 5, for the last. The mean is

$$\bar{X} = \frac{5 + 4 + 3 + 3 + 4.5 + 2 + 5}{7} = 3.78$$

For the example given in Table 1 the mean for the first colloquia is 8.65 and for the second is 11.7.

D. Variance and Standard Deviation

Variance is defined as the average of the squared deviations from the mean. To calculate the variance we use the equations:

A population-based formula:

$$\sigma^2 = \frac{1}{N} * \sum_{i=1}^{N} (x_i - \mu)^2$$

A sample-based formula:

$$s^2 = \frac{1}{n-1} * \sum_{i=1}^{N} (x_i - \bar{x})^2$$

The Standard Deviation is a measure of how spread out the numbers in a distribution are or it shows how much, on average, each of the values in the distribution deviates from the mean. It is calculated as square root of the variance. To calculate the Standard Deviation we use the equations:

A population-based formula:

$$\sigma = \sqrt{\frac{1}{N} * \sum_{i=1}^{N} (xi - \mu)^2}$$

A sample-based formula:

$$s = \sqrt{\frac{1}{n-1} \sum_{i=1}^{N} (x_i - \bar{x})^2}$$

Variance is separated by Standard Deviation by only one-step in calculations!

Here is an example for calculating variance and standard deviation. The file contains the following samples: 4, 3, 5, 3, 4 and 5.

First we are going to calculate the mean

$$\bar{X} = \frac{4+3+5+3+4+5}{6} = \frac{24}{6} = 4$$

Therfore, μ and $\bar{x}$ are 4.

For the variance we have

$$\sigma^2 = \frac{1}{N} * \sum_{i=1}^{N} (x_i - \mu)^2 =$$

$$= \frac{1}{6} * \{(4-4)^2 + (3-4)^2 + (5-4)^2 + (3-4)^2 + (4-4)^2 + (5-4)^2\} = \frac{1}{6}\{(-1)^2 + 1^2 + (-1)^2 + 1^2\} = \frac{4}{6} = 0.67$$

$$s^2 = \frac{1}{n-1} * \sum_{i=1}^{N} (x_i - \bar{x})^2 =$$

$$= \frac{1}{5} * \{(4-4)^2 + (3-4)^2 + (5-4)^2 + (3-4)^2 + (4-4)^2 + (5-4)^2\} = \frac{1}{6}\{(-1)^2 + 1^2 + (-1)^2 + 1^2\} = \frac{4}{5} = 0.80$$

The variance of population is 0.67 and the variance of sample is 0.80.

The Standard Deviation for population is:

$\sqrt{0.67} = 0.82$

The Standard Deviation for sample is:

$\sqrt{0.80} = 0.89$

For the example given in Table 1 for the first colloquia the variance of population is 29.5 and the variance of sample is 32.78. For the second colloquia, the variance of population is 24.81 and the variance of sample is 27.57. The Standard Deviations are stdev.s=5.72 and stdev.p=5.43 for the first colloquia and stdev.s=5.25 and stdev.p=4.98 for the second.

E. Rang

The Range is the difference between the lowest and highest values in the data set.

In the set {5, 8, 7, 9, 3, 6} the lowest value is 3, and the highest is 9, so the range is 9 – 3 = 6 Fig.12

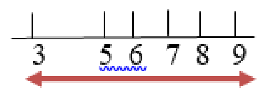

Figure 7 Range

For the example given in Table 1 the ranges are 19 and 15 respectively for the first and for the second colloquia.

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Bellman-Ford and Floyd Warshall Algorithms for Easier Learning

N. Stojkovikj, M. Kocaleva, B. Zlatanovska, A. Stojanova
Faculty of computer science, "Goce Delcev" University, Stip, Republic of Macedonia
natasa.maksimova@ugd.edu.mk, mirjana.kocaleva@ugd.edu.mk, biljana.zlatanovska@ugd.edu.mk, aleksandra.stojanova@ugd.edu.mk

Abstract - In this paper, Bellman-Ford and Floyd Warshall Algorithms will be considered. Floyd-Warshall is used when we want to find the shortest path between all the pairs of nodes in graph. The Bellman-Ford algorithm is similar to Dijkstra algorithm, but it is used when the graph may also contain links with negative weights. The algorithms are implemented in Java and visualized for easier learning.

I. INTRODUCTION

Graphs are abstractly mathematical objects that are often used in everyday life:

- a geographical map with many cities connected with path;
- set of people somehow connected;
- Structural formula of a molecule or compound;
- Scheme diagram of an electrical circuit.

Graph describes the relationship between lines and points. A graph consists of some points and lines between them. The points are called nodes or nodes and the lines are called edges or links.

Formally, a graph is a pair (V, E), where V is a finite set of nodes and E a finite set of links.

The graphs are used for describe models and data structures. The structure of a web presentation can be graphically represented by the use of the graph. The nodes of that graph are individual pages, and the edges of the graph are the links that one page can pass to another.

There are several types of graphs:

- A simple graph in which there are no loops and parallel links.
- A regular -graph in which all nodes have the same degree (the number of links incident to the vertex).
- A complete graph Kn is a graph with n nodes in which each two nodes are adjacent.
- Bipartite graph is a simple graph G whose set of nodes can be separated into two non-empty disjunction sets V1 and V2 so that the nodes of V1 can be linked with V2 nodes, but no V1 theme is linked to a V1 itself and no V2 theme is linked to a V2 theme itself.

II. BELLMAN-FORD ALGORITHMS

Bellman-Ford algorithm is an algorithm that find the shortest paths from a single source in a directed weight graph (Figure 1). The name of this algorithm comes from Richard Bell and Leicester Ford, who first published it in scientific papers in 1958 and 1956, but Alfonso Schimbel first proposed this algorithm as a solution since 1955. The advantage of the Belman-Ford algorithm vs. classical algorithms for searching the shortest paths as the Dijkstra algorithm is that it can work with graphs that have links with negative weights. This algorithm is slower that Dijkstra and is more complex. Rarely, we have graphs where the weights of links are negative numbers [1], [2]

```
BELLMAN-FORD(G,w,s)
   INITIALIZE-SINGLE-SOURCE(G,s)
   for i = 1 to |G.V|-1
      for each edge (u,v) ∈ G.E
         RELAX(u,v,w)
   for each edge (u,v) ∈ G.E
      if v.d > u.d + w(u,v)
         return FALSE
   return TRUE

INITIALIZE-SINGLE-SOURCE(G,s)
   for each vertex v ∈ G.V
      v.d = ∞
      v.pi = NIL
   s.d = 0

RELAX(u,v,w)
   if v.d > u.d + w(u,v)
      v.d = u.d + w(u,v)
      v.pi = u
```

Figure 1 The pseudo code for the algorithm

In Figure 2, is given graph with 5 nodes and links between them.

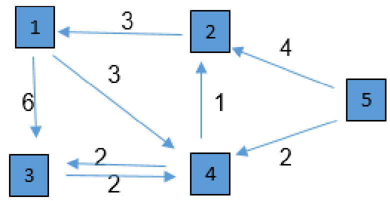


Figure 2 Directed graph

For node 5:

Iteration 0: Node 5 is source (the distance is inicialized to zero), distance to the other nodes are inicialized to ∞. (Figure 3)

Итерација 0:

	5	4	3	2	1
d	0	∞	∞	∞	∞
p	/	/	/	/	/

Figure 3 Iteration 0

Iteration 1: We relax the links (u5,u2) and (u5,u4) and update the distances to 2 and 4. The iterations 1 is given in Figure 4.

Итерација 1:

	5	4	3	2	1
d	0	2	∞	4	∞
P	/	5	/	5	/

Figure 4 Iteration 1

The iterations 2 and 3 are given in Figure 5 and Figure 6.

Итерација 2:

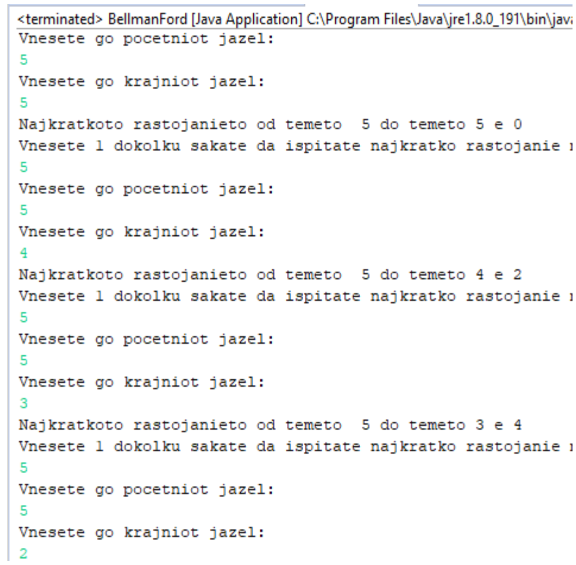
	5	4	3	2	1
d	0	2	4	3	7
p	/	5	4	4	2

Figure 5 Iteration 2

Итерација 3:

	5	4	3	2	1
d	0	2	4	3	6
p	/	5	4	4	2

Figure 6 Iteration 3



```
<terminated> BellmanFord [Java Application] C:\Program Files\Java\jre1.8.0_191\bin\java
Vnesete go pocetniot jazel:
5
Vnesete go krajniot jazel:
5
Najkratkoto rastojanieto od temeto  5 do temeto 5 e 0
Vnesete 1 dokolku sakate da ispitate najkratko rastojanie
5
Vnesete go pocetniot jazel:
5
Vnesete go krajniot jazel:
4
Najkratkoto rastojanieto od temeto  5 do temeto 4 e 2
Vnesete 1 dokolku sakate da ispitate najkratko rastojanie
5
Vnesete go pocetniot jazel:
5
Vnesete go krajniot jazel:
3
Najkratkoto rastojanieto od temeto  5 do temeto 3 e 4
Vnesete 1 dokolku sakate da ispitate najkratko rastojanie
5
Vnesete go pocetniot jazel:
5
Vnesete go krajniot jazel:
2
```

Figure 7 Bellman-Ford algorithm (Java implementation)

III. Floyd Warshall Algorithms

The Floyd Warshall algorithm is used when we want to find the shortest paths between all pairs of nodes in a graph. This algorithm is an example of dynamic programming [3], [4].

The following graph with 6 nodes is given.

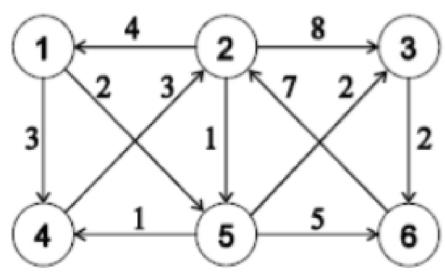


Figure 8 Floyd Warshall algorithm

The procedure for finding the shortest path using this algorithm is that with several iterations it forms few matrices. The first matrix is filled in if there is a link between the i - th and the j - th node appropriately inserts the weight value; if such a link does not exist, we put a sign ∞. In cases when we need to insert a value of a link whose end and beginning is the same node, we put 0 because we can notice that there are no loops.

Each subsequent matrix is created according to the rule min (d_{ij}, $d_{ik} + d_{kj}$) so that k is the constant that initially increases with each subsequent matrix creation. The size d_{ij} is defined as the minimum weight of the path from the node j to the node i with medium nodes of the set {1,2 ... k}.

On this way, we obtain the following results:

$$C^0 = C = \begin{bmatrix} 0 & \infty & \infty & 3 & 2 & \infty \\ 4 & 0 & 8 & \infty & 1 & \infty \\ \infty & \infty & 0 & \infty & \infty & 2 \\ \infty & 3 & \infty & 0 & \infty & \infty \\ \infty & \infty & 2 & 1 & 0 & 5 \\ \infty & 7 & \infty & \infty & \infty & 0 \end{bmatrix}$$

Figure 9 Matrix $C^0 = C^1$

$$C^2 = \begin{bmatrix} 0 & \infty & \infty & 3 & 2 & \infty \\ 4 & 0 & 8 & 7 & 1 & \infty \\ \infty & \infty & 0 & \infty & \infty & 2 \\ 7 & 3 & 11 & 0 & 4 & \infty \\ \infty & \infty & 2 & 1 & 0 & 5 \\ 11 & 7 & 15 & 14 & 8 & 0 \end{bmatrix}$$

Figure 10 Matrix C^2

$$C^3 = \begin{bmatrix} 0 & \infty & \infty & 3 & 2 & \infty \\ 4 & 0 & 8 & 7 & 1 & 10 \\ \infty & \infty & 0 & \infty & \infty & 2 \\ 7 & 3 & 11 & 0 & 4 & 13 \\ \infty & \infty & 2 & 1 & 0 & 4 \\ 11 & 7 & 15 & 14 & 8 & 0 \end{bmatrix}$$

Figure 11 Matrix C^3

$$C^4 = \begin{bmatrix} 0 & 6 & 14 & 3 & 2 & 16 \\ 4 & 0 & 8 & 7 & 1 & 10 \\ \infty & \infty & 0 & \infty & \infty & 2 \\ 7 & 3 & 11 & 0 & 4 & 13 \\ 8 & 4 & 2 & 1 & 0 & 4 \\ 11 & 7 & 15 & 14 & 8 & 0 \end{bmatrix}$$

Figure 12 Matrix C^4

$$C^5 = \begin{bmatrix} 0 & 6 & 4 & 3 & 2 & 6 \\ 4 & 0 & 3 & 2 & 1 & 5 \\ \infty & \infty & 0 & \infty & \infty & 2 \\ 7 & 3 & 6 & 0 & 4 & 8 \\ 8 & 4 & 2 & 1 & 0 & 4 \\ 11 & 7 & 10 & 9 & 8 & 0 \end{bmatrix}$$

Figure 13 Matrix C^5

$$C^6 = \begin{bmatrix} 0 & 6 & 4 & 3 & 2 & 6 \\ 4 & 0 & 3 & 2 & 1 & 5 \\ 13 & 9 & 0 & 11 & 10 & 2 \\ 7 & 3 & 6 & 0 & 4 & 8 \\ 8 & 4 & 2 & 1 & 0 & 4 \\ 11 & 7 & 10 & 9 & 8 & 0 \end{bmatrix}$$

Figure 14 Matrix C^6

By executing the Floyd Warshall algorithm, we get the matrix C^6 that gives the shortest paths between all the pairs of nodes in the graph. For that purpose, it is necessary first to insert the graph through the matrix of neighborhood.

0
Najkratkite patista na site parovi od jazli se dadeni so:

	1	2	3	4	5	6
1	0	6	4	3	2	6
2	4	0	3	2	1	5
3	13	9	0	11	10	2
4	7	3	6	0	4	8
5	8	4	2	1	0	4
6	11	7	10	9	8	0

Figure 15 Floyd Warshall algorithm (Java implementation)

IV. CONCLUSION

In the paper Bellman-Ford and Floyd Warshall algorithms were considered and implemented in Java programming language. This was made because we think that with graph visualization students can learn algorithms more easily and with great desire. Despite programming languages, there are so many other software for algorithm visualization [5], [6], [7]. So our next goal is to choose a good software and to use it for algorithms visualization.

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Determining Factors for Enrollment at the Technical faculty “Mihajlo Pupin” in Zrenjanin

T. Radmanović*, N. Ranković**, D. Radosav*, D. Ranković***, M. Bjelica*
*University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
** University of Novi Sad, Faculty of Sciences, Novi Sad, Republic of Serbia
***Medical School "Dr Misa Pantic", Valjevo, Republic of Serbia
t.radmanovic@yahoo.com, nrankovic.de@gmail.com, radosav@tfzr.uns.ac.rs,
nr17031994@gmail.com, bjelica@tfzr.uns.ac.rs

Abstract - In this paper we will present the results from the research about the factors which with certain extent determined students to enroll some of the courses (programs of studies) at the Technical Faculty “Mihajlo Pupin” in Zrenjanin, University of Novi Sad. An anonymous survey was used on the all actual courses for getting the answers from students. The obtained results of research are analyzed with the reliable statistical tool IBM SPSS Statistical, which includes a variety of analyses and statistical tests. Revealing the factors which determined students to enroll some of courses at the faculty, could be useful for prosperous development and admission process. The new foreseen rules predict the admission in college based on graduation exams organized at the end of high school education. After determining the most important factors it would be necessary to bring a series of measures in order to improve the enrollment of the most successful students in accredited courses.

I. Introduction

With the choice of high school, students predominantly choose their future profession. A cluster of factors that determined students, after finishing the primary school, to enroll at some secondary school, is further increased in the case of enrollment at faculty. By choosing the faculty and course, future students are choosing their future career development. Their professional life depends on the right choice of study, as well as the achievement of goals, wishes and opportunities, satisfaction or dissatisfaction, finding the appropriate job, and many more. [1], [2]

In Serbia there are approximately 200 high-educational institutions and over 220.000 students. [3] By enrolling at some of the institution, students create opportunities to realize their potentials, build a successful career, meet peers, and get involved in the social life. Modern employers are looking for highly qualified and educated staff with higher education, which is ready to respond to all changes on the labor market and to create new business environment. The expected earnings are higher compared to those without higher education. Therefore, the satisfaction of students with the correct choice of the future profession is of exceptional significance for both the individual as well as the whole society. [4], [5]

Ideal situation would be if every young person, the future student, enroll the faculty and the course which they wanted and chose by themselves. In many cases, the reality is different, the influence of parents, colleagues and friends can change students wishes. Sometimes determining factor is real, e.g. insufficient number of points on the entrance exam. Students often want to enroll the study for vocation that are attractive by their name, and often they don’t know what the future profession carries with itself. In large number of cases, the financial reasons and proximity of the faculty, for example, located in the same or near city, defines students for enrollment at faculty and course. With our research we also wanted to determine to which extent the expectations of students of the Technical faculty in Zrenjanin are fulfilled. In that way, we could determine the desired and realistic factors, with intention that future students be more satisfied and successful in studies, and later become experts in their career. [2], [6], [7]

II. Review of previous researches

Due to an increasing number of new accredited state and private high-educational institutions, there is fierce competition on the market. Modern high-educational institutions operate in conditions of increasing competition, and it is necessary to attract as much as possible of the most successful students, through variety of promotional activities. [1] Besides of the various types of researches that almost every high-educational institution conduct, other ways of attracting students are also needed, such as: accreditation of attractive vocations, professions that offer a promising future career, which bring high earnings, and give promising possibility of employment either in our country or abroad. High-educational institutions often conduct short surveys, to find ways to promote reputation of institution, enabling acquirement a qualitative knowledge and skills, offering conveniences and advantages during study, increase percentage of passing through the exams, enlarge opportunities for employment after finished studies, the increase success of each individual students by tutoring by older students and professors tutors, etc. [2]

III. STRUCTURES OF THE SAMPLE

In the presented research participated 210 students from 7 different courses of under graduated academic studies at Technical faculty "Mihajlo Pupin" in Zrenjanin.

With respect to the enrolled course the structure is following: 41 (19.5%) students of Information Technology studies (IT), 15 (7.1%) students of Engineering Management studies (IM), 26 (12.4%) students of Mechanical Engineering studies (MI), 26 (12.4%) students of Software Engineering studies (SI), 52 (24.8%) students of Clothing Technology studies (OI), 34 (12.4%) students of Industrial Engineering in the Exploitation of oil and gas (NG), and 16 (7.6%) students of Environmental Engineering studies (IZ).

Observed by year of study, the structure of our respondents is: 52 (24.8%) first year students, 52 (24.8%) second year students, 45 (21.4%) third year students, and 61 (29%) fourth year students.

Observed by gender of the students, in the survey participated: 109 (51.9%) male students, and 101 (48.1%) female students.

IV. SUBJECT OF RESEARCH

Students completed the same anonymous survey pool.

First group of questions begins with basic information: enrolled course, gender, and year of study. It continues with two questions which give the opportunity to assess the satisfaction - i.e. fulfillment of one's wishes, expectations, or needs with the chosen faculty, as well as the chosen course.

Second group of questions is related to subjects that students have mastered in high school, and whose pre-knowledge was greatly contributed to determining enrollment at the Technical faculty "Mihajlo Pupin" in Zrenjanin, as well as the specific course.

Third group of questions measure factors that with scaled intensity directly influenced students` choice to enroll certain course on Technical faculty. This group of questions could be partitioned in the three major subsets of determining factors. The first set of questions is related to influence of parents, friends, colleagues, and other persons. The second set of questions are general questions about what students take into consideration during the enrollment, such as: possibility of continuing studies at higher level, opportunities of employment, income level in future profession, and other. Third set of questions is referred to realistic questions such as financial possibilities of student family, proximity to the faculty, and similar.

Fourth and final group of questions includes questions related to student expectations for successful career. [1], [2]

V. USED METODOLOGY

Students' responses were on the **5-point Likert scale**: (**1** means **very bad**, **2** means **bad**, **3** means **satisfactory**, **4** means **good**, **5** means **very good**).

The results obtained by the pool are analyzed with reliable statistical tool ***IBM SPSS Statistics***, [8] which offers variety of analyzes and statistical tests. Kruskal Wallisov H Test KW(H) and its significance was used. For the analysis of questions, Mean and One-Way were used, as well as ANOVA test were used for comparison of the male and female participants` answers on all of 7 courses. [9], [10]

VI. ANALYSIS AND DISCUSSION OF THE RECEIVED RESULTS

TABLE 1.

On the first question, students were assessing the satisfaction with the enrollment at the Technical faculty "Mihajlo Pupin" in Zrenjanin. The most satisfied are the students of Information Technology studies (4.10), then come the students of Clothing Technology studies (4.04), Software Engineering (3.96), Industrial Engineering in the Exploitation of oil and gas (3.68), Mechanical Engineering (3.65), Engineering Management (3.33), and the least satisfied ones are the students of Environmental Engineering studies (2.94). Based on value of Kruskal Wallisovs H Test KW(H)=24.105 and its probability KW(p)=0.000, it can be concluded that there are statistically significant differences in students' answers between courses.

TABLE 1 Student satisfaction assessment by enrollment at the Technical Faculty in Zrenjanin

Label	Studies	Mean	KW(H)	KW(p)
IT	Information Technologies	4.10		
IM	Engineering Management	3.33		
MI	Mechanical Engineering	3.65		
SI	Software Engineering	3.96		
OI	Clothing Technology	4.04		
NG	Industrial Engineering in the Exploration of oil and gas	3.68	24.105	0.000
IZ	Environmental Engineering	2.94		

TABLE 2.

In the second question students evaluated to which extent they are satisfied with the enrolled course. The most satisfied are students of Information Technologies (4.15), then the students of Software Engineering (3.85), same is Clothing Technology (3.85), after that Mechanical Engineering (3.73), Engineering Management (3.53), Industrial Engineering in the Exploitation of oil and gas (3.15), and the least satisfied are students of Environmental Engineering studies (2.81). Based on value of Kruskal Wallisovs H Test KW(H)=26.518 and its probability KW(p)=0.000, it can be concluded that there are statistically significant differences in students' answers between courses.

TABLE 2. Students' satisfaction assessment of students enrolled in the course

Label	Studies	Mean	KW(H)	KW(p)
IT	Information Tecnologies	4.15		
IM	Engineering Management	3.53		
MI	Mechanical Engineering	3.73		
SI	Software Engineering	3.85	26.518	0.000
OI	Clothing Technology	3.85		
NG	Industrial Engineering in the Exploitation of oil and gas	3.15		
IZ	Environmental Engineering	2.81		

TABLE 3.

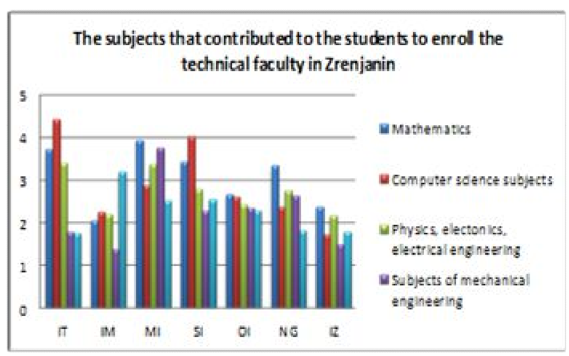
In the second group of In the questions, students evaluated their pre-knowledge and skills in the subjects from secondary schools, that contributed them to enroll in the desired course.

The subject of Mathematics is most often taken on the entrance exam at all technical and related faculties, and it is best rated by students of Mechanical Engineering (3.96), while it is worst rated by students of Engineering Management (2.07).

TABLE 3. Rates of the students of these courses for the listed subjects

Subjects/ Studies	IT	IM	MI	SI	OI	NG	IZ
Mathematics	3.73	2.07	3.96	3.46	2.69	3.35	2.38
Computer science subjects	4.44	2.27	2.88	4.04	2.63	2.38	1.75
Physics, electronics, electrical engineering	3.41	2.20	3.38	2.81	2.46	2.76	2.19
Subjects of mechanical profession	1.80	1.40	3.77	2.31	2.37	2.65	1.50
Economy, business economy	1.76	3.20	2.54	2.58	2.31	1.82	1.81

Computer science subjects have contributed mostly to students of Information Technologies (4.44), and least to students of Environmental Engineering studies (1.75). Physics, Electronics and Electrical engineering have also contributed mostly to students of Information Technologies (3.41), and least to students of Environmental Engineering (2.19). Subjects of Mechanical profession are best rated by students of Mechanical Engineering (3.77), and are worst rated by students of Engineering Management (1.40). Economy and Business Economy are subjects that certainly contributed the most to students of Engineering Management (3.20), and least to students of Information Technology (1.76).



PICTURE 1. A graphic representation of the students' reviews of the indicated courses for the mentioned subjects

TABLE 4.1.

Students` answers in the third group of questions gave estimates of important factors that with scaled intensity determined students to enroll in a chosen course at Technical Faculty. The largest number of IT students determined personal interest in this field (4.59), and least is for students of Environmental Engineering (3.75). The well-known experts have mostly affected the students in the field of Mechanical Engineering (3.46), same as Clothing Technology (3.46), and least for students of Environmental Engineering (1.88). Recommendations and influence of parents have affected mostly to students of Mechanical Engineering (3.65), and least to students of Environmental Engineering (2.69). Recommendations and influence of high school professors have mostly contributed to the students of Software Engineering (3.42), and least to students of Industrial Engineering in the Exploitation of oil and gas (2.26). Recommendations and influence of colleagues and friends have mostly affected students of Engineering Management (3.47), and the least students of Software Engineering (2.62).

TABLE 4.1. Determining factors for enrollment in some of the courses at the Technical Faculty in Zrenjanin

Factors/ Studies	IT	IM	MI	SI	OI	NG	IZ
Personal interest in this area	4.59	3.93	4.31	4.04	4.48	4.03	3.75
Known experts in this area	2.78	2.67	3.46	3.12	3.46	2.21	1.88
Recommendations and the influence of your parents	2.98	3.13	3.65	3.31	3.15	2.76	2.69
Recommendations and the influence of yours professor in high school	3.00	3.07	3.38	3.42	3.29	2.26	2.44
The influence of your colleagues and friends	2.98	3.47	3.19	2.62	2.87	2.76	2.69

TABLE 4.2.

The promotional activities of the Faculty itself about potentials of future successful career that can be achieved through education at the Technical Faculty “Mihajlo Pupin” in Zrenjanin - have mostly affected students of Industrial Engineering in the Exploitation of oil and gas (3.79), and least students of Environmental Engineering (2.63). The perspective profession in the future had best affection on the students of Information Technologies (4.63), and the worst on students of Engineering Management (3.13). High earnings and good income have mostly affected on students of Information Technologies (4.59), same as students of Industrial Engineering in the Exploitation of oil and gas (4.59), and least affected on students of Environmental Engineering (3.44).

TABLE 4.2. Determining factors for enrollment in some of the courses at the Technical Faculty in Zrenjanin

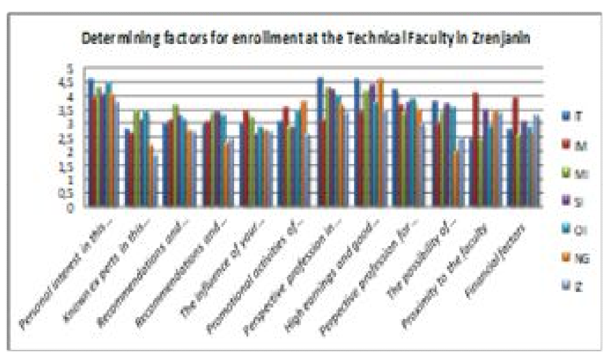
Faktors/Studies	IT	IM	MI	SI	OI	NG	IZ
Promotional activities of the faculty about a future successful career in this area	3.10	3.60	2.88	2.88	3.46	3.79	2.63
Perspective profession in a future	4.63	3.13	4.31	4.23	4.00	3.68	3.38
High earnings and good income in this area	4.59	3.40	4.19	4.38	3.77	4.59	3.44

TABLE 4.3.

Obtaining perspective profession with possibility of going abroad have mostly affected students of Information Technologies (4.22), and least on students of Environmental Engineering (3.00). Possibility of establishing his/her own business have influenced mostly on students of Information Technologies (3.78), and least on students of Industrial Engineering in the Exploitation of oil and gas (2.00). Proximity of faculty have mostly influenced on students of Engineering Management (4.07), and least on students of Information Technologies (2.44). Financial factors have mostly affected students of Engineering Management (3.93), and least students of Mechanical Engineering (2.58).

TABLE 4.3. Determining factors for enrollment in some of the courses at the Technical Faculty in Zrenjanin

Factors/Studies	IT	IM	MI	SI	OI	NG	IZ
Perspective profession for going abroad	4.22	3.67	3.38	3.77	3.88	3.51	3.00
The possibility of establishing your own business	3.78	3.00	3.42	3.69	3.58	2.00	2.50
Proximity to the faculty	2.44	4.07	2.46	3.50	2.92	3.47	3.38
Financial factors	2.78	3.93	2.58	3.08	2.87	2.65	3.31



PICTURE 2. Determining factors for enrollment at the Technical Faculty in Zrenjanin

TABLE 5.

Based on value of Kruskal Wallisovs H Test KW(H) and its probability KW(p), it can be concluded that there are statistically significant differences in most of the factors, that have determined students to enroll at Technical Faculty, between courses – featured by red color.

TABLE 5. Significant differences in determining factors for enrollment in study depending on studies.

Determining factor	Mean	KW(H)	KW(p)
Personal interest in this area	**4.26**	22.197	**0.001**
Known experts in this area	2.90	29.437	**0.000**
Recommendations and the influence of your parents	3.10	8.266	0.219
Recommendations and the influence of professors in high school	3.01	19.681	**0.003**
The influence of your colleagues and friends	2.91	5.954	0.428
Promotional activities of the faculty about a future successful career in this area	3.25	13.798	**0.032**
Perspective profession in a future	4.03	39.330	**0.000**
High earnings and good income in this area	4.14	47.673	**0.000**
Perspective profession for going abroad	3.80	15.716	**0.015**
The possibility of establishing your own business	3.23	38.900	**0.000**
Proximity to the faculty	3.05	21.493	**0.001**
Financial factors	2.71	11.484	0.075

TABLE 6.

In a major number of all available professions in many countries, the factor "students' gender" is the determining factor for enrollment in some studies or choice of faculty. Based on values of ANOVA Test and its probability, from this research it can be concluded that: there are no statistically significant differences – for almost all factors from this questionnaire – between genders, male and female students. Two exceptions are featured by red color

TABLE 6. Statistically significant differences in determining factors for enrollment in studies depending on gender.

Determining factors of students		Mean	ANOVA test	ANOVA(p)
Personal interest in this area	**male**	4.19	1.036	0.310
	female	4.33		
Known experts in this area	**male**	2.92	0.018	0.894
	female	2.89		
Recommendations and the influence of your parents	**male**	3.12	0.041	0.839
	female	3.08		
Recommendations and the influence of professor in high school	**male**	2.94	0.757	0.385
	female	3.10		
The influence of your colleagues and friends	**male**	2.92	0.008	0.929
	female	2.90		
Promotional activities of the faculty about a future successful career in this area	**male**	3.21	0.152	0.697
	female	3.29		
Perspective profession in a future	**male**	4.07	0.389	0.533
	female	3.98		
High earnings and good income in this area	**male**	4.31	6.590	**0.011**
	female	3.95		
Perspective profession for going abroad	**male**	3.99	5.407	**0.021**
	female	3.58		
The possibility of establishing your own business	**male**	3.30	0.507	0.477
	female	3.16		
Proximity to the faculty	**male**	3.01	0.135	0.713
	female	3.09		
Financial factors	**male**	2.87	0.191	0.662
	female	2.96		

TABLE 7.

In the fourth group of questions, students have expressed their expectations in career development, after completing their studies of chosen course at Technical Faculty in Zrenjanin.

TABLE 7. Student expectations in future career depending on ther

Expecting students in future careers	IT	IM	MI	SI	OI	NG	IZ
In the area you are currently studying	**4.49**	3.60	4.19	4.15	4.44	3.85	**3.31**
In some other area, where you find a job	2.76	3.20	2.38	**3.42**	3.06	2.88	**2.55**
In a well-paid area abroad	**3.90**	3.20	**2.88**	3.46	3.48	3.41	**2.88**
As owner of own company	**3.71**	2.93	3.58	3.65	3.58	**2.18**	2.50

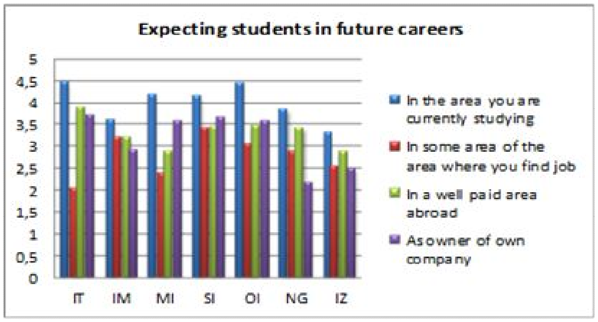
study program

Most students expect a successful career in the area they are currently studying: the most expectations have students of Information Technologies (4.49), and least are students of Environmental Engineering (3.31).

In some other area, where they can find job, mostly are students of Software Engineering (3.42), and least the students of Environmental Engineering (2.55).

In the well-paid area abroad would be better carrier, mostly for students of Information Technologies (3.90), and least for students of Environmental Engineering (2.88) and Mechanical Engineering (2.88).

As the owner of its own company, it would be the best to manage business for students of Information Technologies (3.71), and worst for the students of Industrial Engineering in the Exploitation of oil and gas (2.18).



PICTURE 3. Student expectations in future career depending on study program

TABLE 8.

Based on values of Kruskal Wallisovs' H Test KW(H) and its probability KW(p), we can conclude that there are statistically significant differences in most of the ratings of students' expectations in future career, between courses.

TABLE 8. Statistically significant differences in student expectations in a future career depending on gender

Expecting students in future careers	Mean	KW(H)	KW(p)
In the area you are currently studying	4.14	27.451	0.000
In some other area, where you find a job	2.76	27.010	0.000
In a well-paid area abroad	3.41	13.700	0.033
As owner of own company	3.26	29.895	0.000

VII. CONCLUSION

Based on the all conducted analyses, it can be concluded that students of Information Technologies are most satisfied with chosen faculty, and choice of IT course. Enrollment in this course was significantly predicted by their pre-knowledge of IT subjects, but also from Physics, Electronics and Electronical engineering. It also should be pointed out that for the students of Mechanical engineering the enrollment was greatly contributed by the pre-knowledge from the subjects Mathematics, Physics, Electronics and Electrical engineering. The most unsatisfied are students of Environmental Engineering, where more detailed analyses should be done, especially to find the causes of such assessments, since the given profession is important and has a perspective in future. Personal interests, prospective profession in the future, high salaries are determining factors for students of Information Technologies to choose his profession. There are no relevant statistically significant differences in the responses of students of male and female gender, which is of great importance from several aspects.

It is necessary to perform more frequent researches in order to find means to mitigate detected negative factors, as well as to find unrecognized factors which negatively influence on the successful studies on the Technical Faculty. It is important to analyze all potential impacts on students' orientations toward specific courses, and for each course individually, to bring a series of activities in order to improve student satisfaction which should be continued and increased in the future. Such a promising faculty, which respects all participants in the educational process, which develops correctness, collegiality and readiness to deal with all changes – should keep its tradition and continue to enroll the most successful students. [1], [2], [11].

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Implementation of the System for E-Learning of Employees Based on Chamilo LMS

L. Krstić, M. Krstić V. Stanković
Higher Business School of Professional Studies, Leskovac, Republic of Serbia
krstic.lazar@vpsle.edu.rs, krstic.marija@vpsle.edu.rs, stankovic.valentina@vpsle.edu.rs

Abstract - Competent and reliable staff are the foundation of a successful business. In this regard, it is necessary to ensure continuous development of knowledge and skills of employees, bearing in mind that this is an important step, as the concept of learning in institutions can increase their efficiency and innovation, therefore, the business results as well. The aim of the paper is to present the best and most popular open-source e-learning management solutions, as well as the implemented system dedicated to the innovation of employees' knowledge based on Chamilo LMS.

I. INTRODUCTION

Information and communication technologies (ICTs) play an important role in many areas of modern society, representing one of the main areas in the modern life of people and an inseparable part of their everyday activities and actions. These technologies, especially in the form of computers and the Internet, have enabled the expansion of e-learning in many institutions. Their implementation provides, in addition to the acquisition of revelent information, additional knowledge and skills on the usage of the technologies used in the learning process. In today's turbulent times, it is important to adequately respond to business changes, and constant learning - both individual and group learning - at the institution level is the only way to achieve this.

Electronic learning is an extremely broad concept which represents numerous methods of learning with the support and use of ICT. It is realized through the application of one of the Learning Management Systems. Most of these systems are web-based, which contributes to user customization and provides access to educational content and materials in flexible frameworks. In addition, it is also possible to monitor user progress, and to test and verify knowledge, to analyze the achieved results and plan for further development of users.

II. E-LEARNING MANAGEMENT SYSTEMS

Learning Management System (LMS) is a software solution used for the automatization of the educational content administration. This system manages user registrations and applications, and course catalogs. It records attendance data and creates final reports. It also includes a set of functionalities for monitoring, reporting and administration of learning content, monitoring student progress, testing, knowledge assessment, analysis of knowledge weaknesses and planning the students' further development, while also enabling interactions between students and mentors, as well as interactions among the students themselves. Most of these systems are based on web technologies. The abbreviation LMS can be represented as:

- Learning - because it is used to supply courses or training programs;
- Management - because it helps with course organization (creating, editing, assigning to students...);
- System (platform) - a word that refers to software, or computer program.

A. *Review and analysis of an open source e-learning management system*

When it comes to choosing a solution for the implementation of a learning management system, the question arises whether to choose one of the commercial ones, or opt for a free, and even open-source solution. Commercial solutions primarily include user and technical support, detailed documentation on the use of the system, and often advisory services when planning the implementation of training.

On the other hand, when it comes to free, open-source solutions, changes, and documentation on the use of the system are regularly updated, and are constantly being improved, but do not include user and technical support. The group of most popular free, open-source solutions includes Moodle, Chamilo, ATutor, Claroline, eFront, Sakai.

Which solution will be chosen as the final depends on several factors, including the following:

- who are the intended course participants,
- how much are the users who will be using the system expert and familiar with the way the system is used,
- whether the desired system is available, in terms of whether it can be installed on your own server or if it needs to be rented as a service,
- which tools would you like to use within the system,
- whether the system offers quality user and technical support.

B. *Review of free open-source platforms for e-learning*

Below is a review of the most popular, free, open-source platforms for e-learning. Open-source software refers to software whose source code is available - within the "open-source" license - to all users who can change, edit and improve its content [1]. This means that "open-source" programs also contain entire source code in some programming language, which is not the case with paid software.

Moodle (an acronym for a Modular Object-Oriented Dynamic Learning Environment) is an open-source platform for creating and maintaining educational courses using computers and the Internet. It is installed on the server and accessed from any networked computer through a web browser. In fact, it represents a unified toolkit that allows access to common knowledge sources, the exchange of educational materials, and the use of additional modules which help extend the functionality. Moodle is primarily intended for institutions that deal with education, although it can also be used outside of this, relatively speaking, "institutional" context [2].

Chamilo is a web-based open-source platform for creating and managing online courses, with the support of simultaneous work and learning, which aims to improve the approach to education and knowledge around the world. Chamilo platform is currently used by more than 3.5 million users from around the world and its application is still developing. Governments, private companies, state and private universities, NGOs and other organizations use Chamilo to manage a range of tasks from remote routine business training, to obtaining certifications and staff selection.

ATutor is an open-source platform developed as a support for teaching and learning. It is web-based and provides content management for learning on a local computer, on a local network or on the Internet. It is characterized by fast installation and updates, as well as a simple extension of functionality using modules. The ATutor environment is accessible and adaptive, and its usage is supported by plenty of documentation and user instructions. It is considered a cost-effective tool for small and large organizations, which display their teaching materials on the Internet, as well as completely independent online courses [3].

Claroline is a collaborative open-source platform that enables course creation and management, as well as the creation of space for online collaboration with hundreds of organizations around the world (universities, schools, companies, associations...). Its personalization possibilities and easy navigation make it possible to be used by people with no special technical skills. It is based on a flexible education model where information becomes knowledge through activities, in a system that encourages motivation and interaction [4].

eFront is an open-source e-learning platform. It is primarily intended for medium-sized organizations (from 100 to 10,000 users) and has very good professional support. With its simple and visually appealing interface, it seeks to stimulate the desire for knowledge and maximize newly acquired skills while simultaneously facilitating the use of the platform. Functions such as skills management, organizational structure, and supervision make this system particularly useful for training staff of the human resources department [5].

Sakai is a community composed of academic institutions, business organizations and individuals developing Collaboration and Learning Environment (CLE). Sakai CLE is a free educational software platform distributed under the license of a teaching community. Sakai is an open-source platform with great possibilities, developed as a support for collaboration and learning. It can be used for full online lectures or as a support to traditional learning [6].

C. *Analysis of the Chamilo platform according to the "SECTIONS model"*

In a specific case, the decision on the software solution which will be applied to implement the e-learning system of the employees is based on the analysis according to the "SECTIONS model." This model represents a working framework for the selection and application of technology, i.e. it helps and facilitates decision-making related to technology at the strategic and tactical level - by choosing the most appropriate one. The abbreviation SECTIONS covers eight criteria groups related to key issues [7]:

- Students - it includes certain facts related to students' knowledge - who are being introduced with new technologies - in terms of their skills related to new technologies, students' ability to access computers, the demographic difference of students, the type of programs which should be offered to students, the clear methods and policies of the institution regarding the introduction of e-learning, the kind of technology that will be applied, the desire to partially introduce the chosen technologies...
- Ease of Use - is reflected in the ease of using new technologies in such a way that students and lecturers will not have to spend a lot of time in mastering the tools offered within the program. This means that user instructions should be clear and simple, and the program interface should be intuitive and well-structured.
- Costs - refers to the price of the license of the desired software solution, the possible number of program users (which greatly affects the cost of purchasing and program support), the cost of technologies, the time spent in maintaining them, the cost of experts and administrative support, and the cost of teaching support. ..
- Teaching and learning - is viewed in the context of a careful selection of media and technologies, widely open to all possibilities, bearing in mind their rapid development as well as the diversity in terms of the population who will use them, i.e. whether the selected technologies are really used for the purpose of teaching and learning.
- Interactivity - is an essential part of teaching and learning, because interactivity can show the level of students' understanding and acceptance of e-learning, and what needs to be changed or improved. This is the only way teachers can monitor the progress of their students, while students can see and control their own personal progress.
- Organizational issues - are based on timely, coherent, active and attentive support, without which there would be no efficient application of new technologies.
- Novelty - refers to the monitoring of new, up-to-date technologies and choosing the right technologies, while taking care to purchase the tested and verified ones.
- Speed - is related to the pace of courses, in terms of creating, starting, and correcting.
- By exhaustively analyzing the Chamilo platform, according to the above-mentioned model, the following can be concluded:
- Students - Chamilo platform is suitable for use in almost all institutions (governments, local governments, private companies, state and private universities, NGOs), and for users who are more or less computer literate, since what they need to know can be learned in a relatively short period of time by using clearly and simply written user instructions.
- Ease of Use - The Chamilo platform itself is not complicated for use by students and lecturers since the tool interface itself is quite intuitive and well structured. However, it is advisable to organize short several hours long course where users who have not previously worked with this platform could be introduced to it.
- Costs - Chamilo Platform is a free, open-source solution and buying a license is not required for its use, therefore, the largest item in total costs (license) is avoided in this way. Assuming that users have computers and Internet access, other costs that might arise are costs related to expert and administrative support, that is, the costs of teaching support, which should not be a large cost.
- Teaching and Learning - The Chamilo Platform allows the combination of different types of learning. For example, it is very easy to add materials which students must learn to the platform itself. Also, their knowledge can be tested in a simple way by creating electronic tests. On the other hand, Chamilo offers the opportunity to gradually solve tasks through an appropriate learning path, as well as monitoring student activities and reporting.
- Interactivity - Chamilo platform supports almost all possible types of interactivity (lecturer-content, lecturer-student, lecturer-lecturer, student-content, student-student).

- Organizational issues - at the institution level it is necessary to solve the problem of the person (or, if necessary, the team of people) who would be in charge of providing support to users during the duration of the course through the Chamilo platform, or he/she should be prepared to organize a short training on the basics of using the platform.
- Novelty - The Chamilo platform is a relatively new tool, with a large number of existing and potential users, and it can be applied in almost all types of institutions.
- Speed - courses in the Chamilo platform can be quickly created, initiated, modified.

Based on the previously performed analysis, a decision was made that the Chamilo platform is a very suitable tool for the implementation of the system of employees' e-learning and knowledge innovation, and in this respect, it will be implemented in practice.

D. Chamilo e-learning system

Chamilo LMS is an open-source tool, owned by Chamilo Nonprofit Organization. It was officially launched in 2010. It supports effective online education and is adapted to the development of both educational and professional projects. It was developed in order to improve the approach to education and knowledge on a global level. It is often referred to as the biggest competition to the most famous LMS - Moodle. In addition to Chamilo LMS, Chamilo LCMS (Learning Content Management System), which is still under development, is also available [8].

Chamilo can be downloaded and used for free, if its terms of use (detailed by the GNU/GPL license) are accepted, which include the freedom to use, study, modify and distribute the software. Namely, anyone can contribute to the development of the Chamilo platform by promoting its use, reporting errors, recommending improvements, translating it into his/her native language or even by developing extensions or fixes.

The Chamilo platform is extremely flexible. All tools can be adapted to the needs of the course, which enables a simple and intuitive interface that does not require any special prior technical knowledge or skills. Some of the more important features of Chamilo LMS, which contribute to its increasing use, include:

- simple creation of educational content,
- a simple interface, the attention of users focused on educational content,
- synchronous and asynchronous communication tools,
- plenty of tools for all types of learning (visual, practical, games),
- cooperation with external systems for data storage,
- user tracking in order to improve the learning methodology.

Chamilo LMS functionalities designed for the organization and presentation of e-learning enable:

- creating SCORM-compliant teaching content, using the UTF-8 standard,
- a description of course content and objectives,
- use of video conferences,
- publishing documents in any of the following formats - SCORM, text, PDF, HTML, video...
- public/private forums and social networks as support to e-learning,
- setting tasks,
- monitoring user progress, user activity statistics,
- use of wiki pages for collaborative document writing,
- management of courses, users and learning paths,
- creating tests and certificates.

III. E-LEARNING SYSTEM FOR EMPLOYEES BASED ON CHAMILO LMS

The implemented system is a web-based software solution that is based on the 'Chamilo LMS' platform. The system incorporates various e-learning tools into one functional entity, with the goal of teaching and/or enhancing existing employee knowledge.

The system includes three levels of user roles:

- System Administrator - maintains and manages the system, keeps track of the course catalog, uploads and sends notifications through the system, registers and keeps track of course participants and lecturers, has the ability to upload a course and monitor its participant evaluation, and to generate summary reports by each course and to issue certificates on completed training.

- Lecturer - creates and organizes personal courses, communicates with course participants, has the ability to monitor the participants' evaluation of his/her courses, as well as to generate summary reports for each course and issue certificates on completed training.
- Course participant (employee) - registers into the system and applies for the course he/she wants to attend, follows the path of learning of the chosen course (studying the given lessons, solving tests and reviewing additional resources), communicates with the lecturer and other course participants.

A. Organization of the first page of the 'E-learning system'

The first page of the 'E-learning system' consists of several blocks (Figure 1):

- a block designed to provide access to the technical support forum, as well as access to reviewing and downloading user instructions;
- a block designed to log users into the system (also includes a drop-down menu for selecting the system language, as well as links leading to the self-registration of the course participants, or the page where they can change a forgotten password);
- a block designed to display daily notifications intended for all system users;
- a block designed to display the most important news (in slider form) to all system users;
- a block designed to display categories and sub-categories of online courses intended for participants;
- a block designed to display the most popular courses on the system;
- a block designed to show the current number of users logged on to the system, as well as options for the online course participants to change the size of the font of the system;
- a block designed to download a mobile application for all system users.

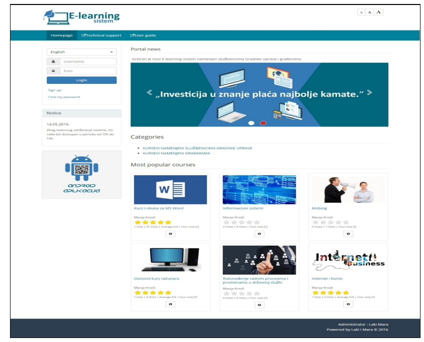

Figure 1. The layout of the first page of the implemented "E-learning system"

B. Access to online courses

Access to online courses - regardless of the category they belong to - requires system registration. In addition to mandatory registration, the courses are protected by the appropriate code, which must be entered in order to access the course contents.

Learning paths are designed to guide students through a particular sequence of learning during each of the uploaded courses. The quality of the learning materials and the proper organization of learning objects within the learning pathway greatly affect the success of coursework. After registering into the system and selecting the desired course, the participant then starts the path of learning of the course that he/she is attending and starts or continues the learning process (Figure 2).

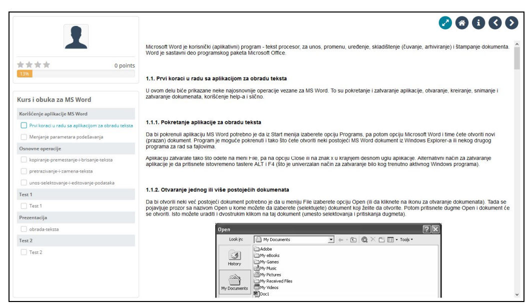

Figure 2. "MS Word Course and Training" (learning path)

Tests are included as learning objects, in addition to lessons. When creating the tests, a selection of the types of questions that provide automatic scoring is carried out, so that the students receive direct feedback on the achieved results. It was decided that each test can be started twice.

It is not possible to randomly select learning objects because appropriate preconditions are set so that the defined learning path must be followed. If a participant gets a sufficient number of points, defined in the assessment tool, after passing the path of learning, he/she can take a certificate on the successful completion of the course.

In order to ensure succesful completion of the course, in addition to learning paths, other tools were selected that can facilitate the learning process for students. In accordance with the characteristics of the target groups for which the courses are intended, the selected tools include (Figure 3):

- Course description - a brief summary of the course.
- Documents - a set of documents and files (text, images, audio, and video) used in the course. The system enables the download of the uploaded lessons and their learning without connecting to the "E-learning system."
- Links - links to external sites that can be of use to participants during the course.
- Tests - examination.
- Announcements - announcements related to the course that will be specified for the participants when they apply for the course.
- Assessments - tracking progress in the form of a simple, personalized view, as well as generating and issuing certificates after successful completion of the course.
- Glossary - a review of terms and definitions.
- Notebook - means for writing, storing and organizing personal notes.
- Chat - an instant messaging tool that allows course users to quickly exchange ideas, questions and answers in writing.

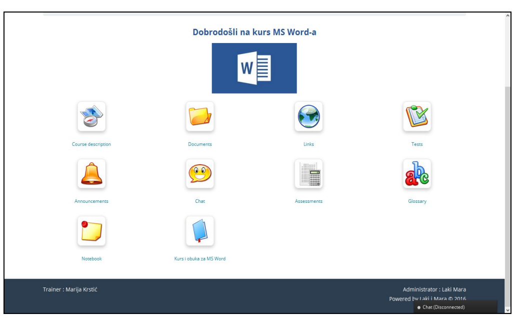

Figure 3. "MS Word Course and Training" (selected tools)

C. Characteristics of the implemented e-learning system

The main features of the implemented system include the following:

- the system allows the administrator to assign courses to groups with deadlines for finishing their assignments,
- the system has the ability to inform the participants about new activities,
- the system allows participants to download the certificate on the completion of training programs,
- the system allows participants to have flexible, ad-hoc reports on their own results while providing the lecturer an insight into all the results,
- the system is available from any computer or mobile device that has Internet access,
- users accessing the system must enter the user name and password,
- the system provides easy password recovery or change,
- the system allows participants to record and continue training from the place they left off,
- the system allows participants to return to the course content to see the questions they gave the wrong answer to when solving the tests.

IV. CONCLUSION

Taking into account all aspects required for the successful implementation of the system of employees' e-learning and knowledge innovation, and by analyzing the available solutions for their practical realization, it has been concluded that the most optimal solution is the use of the Chamilo platform. It is an open-source e-learning platform that is constantly being improved in terms of functionality, and which records constant growth of the users who are applying it. In addition to a large number of educational institutions using this platform all around the world, it is also useful in a business environment. This software solution meets all functional and non-functional system requirements, without the need for additional programming and upgrading. The platform has many tools available that can be used to create courses with different purposes. A well-designed and simple user interface facilitates the use of the platform by students with average IT skills.

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An Overview of Analysis of Students' E-Mails in Their Communication With Teachers

A. Baggia*, D. Gak**, T. Grbić**, S. Medić **, N. Duraković**, A. Žnidaršič*, U. Rajkovič*, A. Tratnik*, J. Jerebić*

*University of Maribor, Faculty of Organizational Sciences, Kranj, Republic of Slovenia
**University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Republic of Serbia
tatjana@uns.ac.rs

Abstract – Nowadays, e-mail correspondence is the basic form of communication between teachers and students in higher education context. Therefore, there is an increasing need for analyzing structures and linguistic forms used by students when writing to their teachers. In this paper, students' e-mails were analyzed from the point of their structure and levels of politeness and formality.

I. INTRODUCTION

For more than two decades, e-mail communication has been the leading form of communication profoundly influencing the way we communicate personally and professionally [1]. E-mails represent a mixture of styles containing both features of written and spoken discourse [2]. E-mails have changed the way we write, the genres we use and how we send and receive information [3]. However, over time, the style of emails has transformed from carefully written formal forms to looser, more informal speech type of writing [4].

One segment of e-mail communication that attracted considerable attention is e-mail communication at university level between students and their teachers. E-mail is considered as one of the most widely used computer-mediated communication tools among university students [5], not only for communicating with each other, but also for their course-related communication [5]. Students' emails tend to be short and to the point, and are characterized by informal spoken style, avoiding conventional grammar and spelling rules and resembling text messages [4]. Structural elements, such as subject line, appropriate addressing, opening, and closing lines reflect all the above.

In the previous decades, there has been a growing interest in e-mail correspondence between students and teachers. Current research on this topic is focused on stylistic features of students e-mails primarily pointing out informality of students e-mails [6], [7], text-based communication viewed as "conversational" [8] and abbreviated forms [9]. An additional factor that needs to be taken into consideration is the fact that communication between students and their teachers is status-unequal [10] which is evident not only in the pragmalinguistic aspects, but also in the structuring of e-mails. Furthermore, much research has been done on the politeness of students' e-mails. The level of politeness and ways of expressing politeness, although rarely investigated in this region, play a crucial role in e-mail structuring, especially when writing subject lines, opening greetings, and sign-offs [11].

This paper aims to explore the preliminary results of a bilateral project (research) set out to examine the way students use openings, main e-mail body and closings of emails, as the key structural elements, to establish and maintain communication with their teachers. These structural elements have been analyzed from the perspective of formality and politeness. To the authors' best knowledge, very few publications can be found that deal with comparative analysis of the corpus of e-mails coming from two different countries and written in three languages (English, Slovene, and Serbian). Therefore, this paper contributes to better understanding of students' preferences and familiarity with writing preferences in three languages at university level in both Slovenia and Serbia.

II. METHODOLOGY

Research has started by collecting a corpus of e-mails from students at two faculties, Faculty of Organizational Sciences, University of Maribor, Slovenia, and Faculty of Technical Sciences, University of Novi Sad, Serbia within the framework of the bilateral project "Statistical

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analysis of business correspondence from the aspect of students' country of origin".

Based on the experience of the researchers and the literature review, the following set of criteria was set up for the structure evaluation of students' e-mails.

The first criterion was the first impression and it was rated by the following scale:
0 - very bad,
1 - bad,
2 - neither bad nor god,
3 - good,
4 - very good.
The scale was adopted from papers [12], [13], [14].

The second criterion was the subject line. Based on results from [13], the scale used for evaluation of the subject line was:
0 - no subject line,
1 - irrelevant subject line,
2 - relevant subject line, not very informative,
3 - relevant, clear and concise description of the purpose.

The investigation of the message body focused on opening, self-identification, closing, sign-off, level of formality and level of politeness.

As in [10] and [15], the following scale was considered for the evaluation of openings of students' e-mails:
0 – no salutation,
1 – informal (conversational) salutation,
2 – formal salutation,
3 – formal salutation with title.

The scale for assessment of proper self – identification was:
0 – none,
1 – incomplete identification,
2 – complete identification.
This scale was based on the investigation from [10].

Based on [13] and [15], the scale:
0 – none,
1 – informal,
2 – formal,
was considered for assessment of closing.

For the investigation of the level of formality, based on [15] the next scale was used:
0 – style of e-mail is informal,
1 – style of e-mail is conversational,
2 – style of e-mail is formal.

For the purpose of investigating the level of politeness, the research team proposed the following scale:
0 – style of e-mail is impolite,
1 – style of e-mail is neutral,
2 – style of e-mail is polite.

Initially, each of the evaluators from the research team evaluated 11 randomly selected e-mails from the database, according to the proposed criteria. The aim was to compare and synchronise the results of all team members, so that the differences in evaluation in the future would be reduced to a minimum. Results are presented in [16].

In the evaluation of students' e-mails, some other criteria, such as sign off, use of emoticons, the reason for writing e-mail, will be considered, as well.

A. Sample characteristics

The collecting of the corpus of e-mails began in October 2018, and by the end of February 2019 the database contains 523 e-mails. Students wrote e-mails to teachers in one of the three languages: Serbian, Slovene and English. Most e-mails from the database are in Serbian, see Table I.

Out of the sample of 523 e-mails, 282 were written by female students (54% of emails), 239 by male students (46%) and in the case of 2 e-mails the gender could not have been determined based on the information provided in the e-mails.

The number of students at certain levels of study who sent e-mails to their teachers from the research group is presented in Table II.

TABLE I. LANGUAGE OF STUDENTS' E-MAILS

Language	*Number*	*Percent*
English	64	12%
Slovenian	124	24%
Serbian	335	64%

TABLE II. LEVEL OF STUDY

Level of study	*Number*	*Percent*
1st Bologna level (Professional)	76	15%
1st Bologna level (Academic)	382	73%
2nd Bologna level (Master)	61	11%
3rd Bologna level (PhD)	4	1%

III. Results and Discussion

According to the research team evaluation based on their first impression, the biggest portion of e-mails were rated as good (46%). Slightly over one fifth of them (21%) were perceived as very good with all the considered elements at a very high level. Furthermore, 25% of e-mails were neither good nor bad and approximately 8% were evaluated as badly written emails. Finally, only 2 e-mails (approximately 0%) were thought to be very badly written. An important implication of these findings is that the majority of students in both countries are familiar with acceptable writing practices. The mean value of the first impression is 2,8 (on the scale 0 - 4), the standard deviation is 0.9 and the coefficient of variation is 32,14%.

The mean value for the criterion regarding subject line is 1.8, the standard deviation is 1.1 and the coefficient of variation is 61,11%. A relevant, clear, and concise description of purpose in the subject line has 31% of students e-mails. In those cases, students used the following: *November exam results*, *Request for office hours*, etc. The subject line of the most e-mails, namely 40%, was relevant but not very informative, stating for instance: *Exam*, *Results*, etc. Remaining e-emails either had irrelevant subject line (8%), for example: *Questions*, *Tomorrow, Name and/or last name*, etc., or had no subject line at all (22%).

The findings regarding e-mail openings show that most students open their e-mails formally (79%) with *Poštovana profesorice, Spoštovani, Dear teacher Last name*, and the like. Only 5% of students' e-mails have no greeting at the beginning, and 16% of them start in an informal manner, such as *Dear*, *Hello*, *Only the first name*, "*Spoštovana First Name*" (in Slovene), "*Draga First name*" (in Serbian), etc. These cases of informal openings are in line with general students' preferences to informal spoken type communication [4].

In regard to e-mail closing, 22% of e-mails in the database do not contain closing. In 15% of cases, students have finished an e-mail with *Bye*, *See you*, "*Pozdrav*" and "*Lep pozdrav*" (in Slovene and in Serbian), i.e. the closing of the e-mail is informal. 63% of students have finished e-mails in a formal way, i.e. they used phrases such as *Sincerely*, *Best regards*, "*Prijazen pozdrav*" (in Slovene), "*Srdačan pozdrav*" (in Serbian).

In 9% of cases, students did not identify themselves and therefore it was not possible to determine the sender of the e-mail. In 10% of cases, self-identification is incomplete, while in 81% of cases students provided their first and the last name and/or identification number, course.

When writing e-mails to their teachers, 62% of students express themselves in a formal way, while 33% use a conversational style, illustrating their inclination towards informal communication. Moreover, it should be pointed out that 5% of students address the teacher in an informal manner, using teachers' first names.

As it was already mentioned, politeness of the received emails has not drawn much attention so far. In the corpus of the collected e-mails, 62% of them were polite, 37% were neutral and only 1% (only 6 of 523 collected e-mails) was impolite or even rude.

The following are example students' emails together with the researcher's evaluations.

Test e-mail No. 1

Subject: homework

Dear *Teacher's First name*,

My homework is in the attachment. I sincerely apologize for not sending it through Moodle. I hope you will read it.

Best regards,

Students' First Name

Clearly, the opening of the e-mail is informal, and the closing is formal. The subject line is relevant, but not very informative. In this case, it is unknown who sent the e-mail since only the first name of the sender is known (i.e. self-identification of the student is incomplete). The e-mail is polite and written in a conversational style (cannot be considered formal since its opening is informal). The researchers' evaluation of this e-mail ranged from being good to being neither good nor bad. However, the final decision was that the e-mail was neither good nor bad due to its directness in addressing the teacher and incomplete self-identification at the end.

For test e-mail No. 2 the first impresion of all evaluators was very good. The e-mail contains all the required elements.

> *Test e-mail No. 2*
>
> Subject**:** Email addresses
>
> Dear Mrs *Teacher's Last name*.
>
> I am writing to confirm the email addresses of all the students for Animation.
>
> The line bellow contains mostly all of the emails of the students.
>
> Looking forward to hearing from you.
>
> Sincerely,
>
> *Students' First Name and Last Name,*
> *Identification number*

The following e-mail is an example of a very badly written student's e-mail.

> *Test e-mail No. 3*
>
> Sent by Moodle
>
> heeyy *Teacher's First name*, how are you ? I been in Belgrade till today and I will start soon
> to finish my work at english, can we talk tomorow on skayp ? thanks for answer
> :) bayyy

Considering the set of criteria, the reason for such an assessment is more than obvious.

The most disagreement in the evaluation has occurred when evaluating the first impression. For this reason, a new criterion - global impression was defined, with the same scale as the first impression, but there has been a very clear and precise agreement on details that an e-mail must satisfy and elements it must contain to receive a certain grade.

IV. CONCLUSION

This paper is a contribution to the ongoing discussion about e-mail communication between university students and their teachers. The main focus was on openings, main body and closings of the students' e-mails, their politeness and formality in e-mail communication with teachers. An important implications of these evidence based results are the facts that more than half of students write very good or good (very good 21% and good 46%) emails to their teachers, 79% of students open e-mails and 63% close e-mails formally, 62% use formal and polite style when writing to their teachers.

In further research, openings, closings, level of formality and level of politeness with respect to the language and country of origin will be investigated.

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Technological Model for Training Students in the Cloud Environment

E. Tosheva
Technical Faculty, SWU "Neofit Rilski", Blagoevgrad, Bulgaria
emilia_tosheva@swu.bg

Abstract – The article presents a technology model for student education in a new, dynamic and interactive cloud environment provided by Google for education. The macrostructure and microstructure of the technological model for student education in cloud environment are presented. In the process of building the model and looking for optimal variants for selecting appropriate and efficient cloud technologies. The choice of a suitable cloud solution is driven by the necessity for synergy between the tools and the pedagogical goals of the training.

I. INTRODUCTION

Term "cloud" is used as a metaphor for the Internet since it doesn't matter where the hardware and software esources that are used are located. For IT professionals cloud computing is a new business model and a new technology platform for developing and deploying applications, and for end-users a new and cheaper way to use applications [1]. Training in the cloud is a new opportunity for effective use of emerging information technologies.

The most common definition of Cloud Computing is given by the National Institute of Standards and Technology of the US NIST [2]. According to him, Cloud Computing is a model that provides a convenient way to obtain network access to a shared set of computing resources, such as Internet networks, servers, data warehouses and applications software, with minimal involvement or management service provider.

Flexibility of the Cloud makes it attractive for consumers, a active participation in the Internet becomes a powerful tool for communication and exchange of information. This quality defines cloud computing as a serious stimulus for achieving excellence in education [3]. Cloud services offered training must be easy to use and access, and to offer free shots used.

II. TECHNOLOGICAL MODEL

Macrostructure of the technological model for training students in the cloud environment.

Technology model for training students in the cloud environment includes: Cloud envairment for education, Cloud resources for eeducation and Cloud education (figure 1).

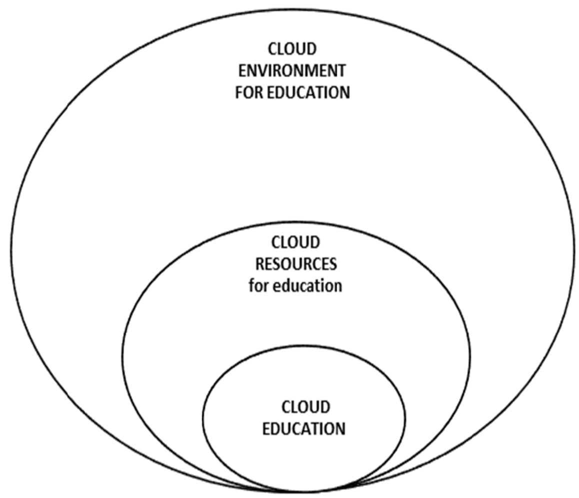

Figure 1 - Macrostructure of the technological model for training students in the cloud environment

A. *Cloud computing for education*

Cloud technologies provide new learning environment that is adaptable in terms of intended learning outcomes by changing the relationship between professor and student.

The new environment allows implementing a new design university course, consistent with the leading paradigms for learning in the 21st century based on constructivism, with a leading self-constructing new knowledge, project work, group work in cloud environments, discussions and chat.

B. *Cloud resources for education*

Cloud resources that are used in training are:

- dynamic web site;
- presentations, text and videos, mind maps, surveys;
- synchronous chat.

For devel resources are used opportunities of cloud applications provided by Google - G Suite for Education-Google Docs, Sheets, Forms, Presentacions, Sites and YouTube.

C. Microstructure technology model

Microstructure technology model includes website "Cloud technologies in education", which contains, three modules with eight generalized topics tailored to the studied discipline. It has the function of a textbook and use every hour of access to learning materials, tests, questionnaires, evaluation forms and self-esteem, videos, useful links. The site serves as a communication tool between students and teacher among students through the opportunity for comments and discussions. One of the valuable qualities of the website is that it is dynamic and allows for easy and rapid updating of content.

The site is located on the Internet at: https://sites.google.com/view/cloudtrejning.

Training of therefore, students in cloud environment is organized (Figure 2).

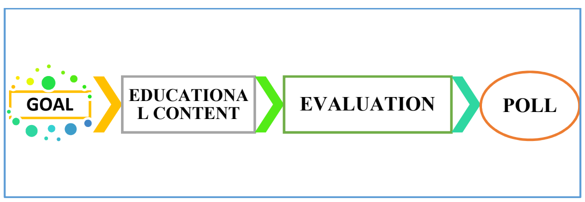

Figure 2 - Organization of the course in cloud environments

The goal of the course "Cloud technologies in education" is for students to acquire knowledge, skills and competences for the use of advanced cloud technologies needed for their professional and educational activities at school.

The content covers (Table 1).

Module	Theme
Module I: Introduction to cloud technologies and their application in the educational process.	1. Cloud technology-being. 2. Use of cloud technologies in education.
Module II: Cloud Technologies MS Office 365 and Google Apps for Education in education.	3.Presentation of MS Office 365 and G Suite for Education. 4.Repositories for documents -Microsoft OneDrive and Google Drive . 5. The educational platform of Google - Google Classroom
Module III. Online creating, editing, sharing documents.	6.Create documents, spreadsheets, forms and presentations online. 7. Create a website with Google Sites. 8.Online creation, editing, sharing of Google Docs.

Table 1. The content covers

Each subject provided practical exercises to master the cloud computing MS Office 365 and G Suite for Education. The model provides a variety of opportunities for training, exchange of information and consolidation of acquired knowledge through practical tasks, creative projects and critical thinking.

D. Evalution

The technological model offers a variety of teaching tools to assess the knowledge, skills and competencies of students. Among the instruments dominate practical tasks and designs to create optimal conditions for transforming knowledge into lasting skills and competences

E. Poll

An important element of the training student feedback, the result of their feedback can serve to improve the quality of teaching and learning. At the end of the course students fill out a survey, which evaluated the training in cloud environments.

III. CONCLUSION

The technological model for training students in the cloud environment provides new opportunities for development of education and personalization of the learning process, for better learning and skills and has the potential to increase the digital competences of students.

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Design of a Web Portal for Preschool Resources Strategic Planning

Lj. Kazi*, D. Karuović*, D. Radosav*, T. Lojović**, A. Kalezić Vignjević***, O. Lakićević***
* University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
** Preschool institution, Zrenjanin, Republic of Serbia
*** CIP center for interactive pedagogy, Beograd, Republic of Serbia
ljubica.kazi@gmail.com, dijanakaruovic@gmail.com, aronradosav@gmail.com, tlojovic@gmail.com, aleksandra@cipcentar.org, olga@cipcentar.org

Abstract – Common resources of educational institutions are usually planned annually and they are based on enrollment data. Strategic planning includes estimations regarding required educational capacities that should be prepared and provided in longer period. This paper presents design elements of a web portal that has been developed as a web application with the purpose of integrating data from various institutions, needed to support preschool resources strategic planning.

I. Introduction

Strategic planning is a process that influences organizational performances and it is related to improvements in quality management. [1] Crucial elements of strategic plan include definition of core values to be achieved, mission, vision, goals and objectives, analysis of external and internal environment and planned activities, i.e. action programs. [2]

Common meaning of resources planning in preschool institutions is, like in any other educational institutions, dependent on the enrollment of children, which changes each year. Therefore, annual planning input data are closely related to the children registration. However, strategic planning is the basis for course of actions that are to be implemented in longer time period. Strategic planning is performed in aim to achieve particular goals with long-term consequences, usually related to the whole society in particular region. When implemented, strategic planning usually result in significant changes in resources and capacities that enable core business processes. Core strategic resources in preschools include buildings and human resources, which should be adjusted to the strategic goals of including children to preschool educational programmes.

This paper deals with the particular case of Serbian preschools, where the strategic goal is set – to include more children in preschool programmes, particularly children from certain categories that were detected as particularly vulnerable. According to this goal, the idea was to detect number of these children and to make a plan of activities to encourage their inclusion and to provide resources to enable their inclusion in preschool programmes.

Aim of this paper is to present elements of software design of Web portal for preschool resources strategic planning, that has been developed within the project aimed to be used at Serbian national level - currently in use at Zrenjanin municipality level [3]. The rest of the paper is organized as follows: second section presents background elements in software design, third section presents related work, fourth section describes business case in strategic plan that is a basis for the software development, the proposed solution design is presented in the fifth section and the final section provides conclusion.

II. Background

The essential background area of this paper is related to software design, particularly for web applications. Experiences in software development from many practitioners are gathered in IEEE book of standards SWEBOK [4], which include software design principles.

According to SWEBOK [4], design is defined as both the process and the result of the process of defining the architecture, components and characteristics of a system or component. According to ISO/IEC./IEE standard 12207 (Software life cycle processes), software design consists of two activities that fit between software requirements analysis and software construction:

- Software architectural design (high level design) – top-level structure and organization of software with components,
- Software detailed design – specifies each component in sufficient detail to facilitate its construction.

According to SWEBOK [4], software design important aspects include:

- Software structure (architecture) – static view,
- User interface design and user interaction modalities,
- Functional design (behavioral, dynamic view),
- Design of information presentation.

All important elements are shaped for each aspect according to the selected design strategy, such as: function-oriented, object-oriented, data structure-centered, component-based and other.

III. RELATED WORK

"A strategic plan in the education sector is the physical product of the strategic planning process that embodies the guiding orientations on how to run an education system within a larger national development perspective, which is evolving by nature and often involves constraints…and offers education institutions opportunity to identify how it will commit resources over the long term in order to accomplish its mission." [5]

Research results that deal with the issues in strategical management of educational institutions are mostly related to higher education. The published research results mostly consider strategic goals accomplishment for particular goals, such as internationalization [6], knowledge management [7], integration with business environments [8] etc.

IV. BUSINESS CASE IN STRATEGIC PLAN

According to previous research results, it is important to use business process model as a basis to software design, in aim to create an appropriate solution, according to the business needs [9].

Business case for the software design is presented at the business process model (Figure 1). There are two swim lanes – first includes activities and data stores related to regularly enrolled children and the second is related to children that are not included in the preschool programme, but will be encouraged to enroll. The basic issue that represent the motivation for creating a web portal is the need for collecting data about the non-included children (from multiple sources, i.e. institutions), and to use the data for predictions and planning.

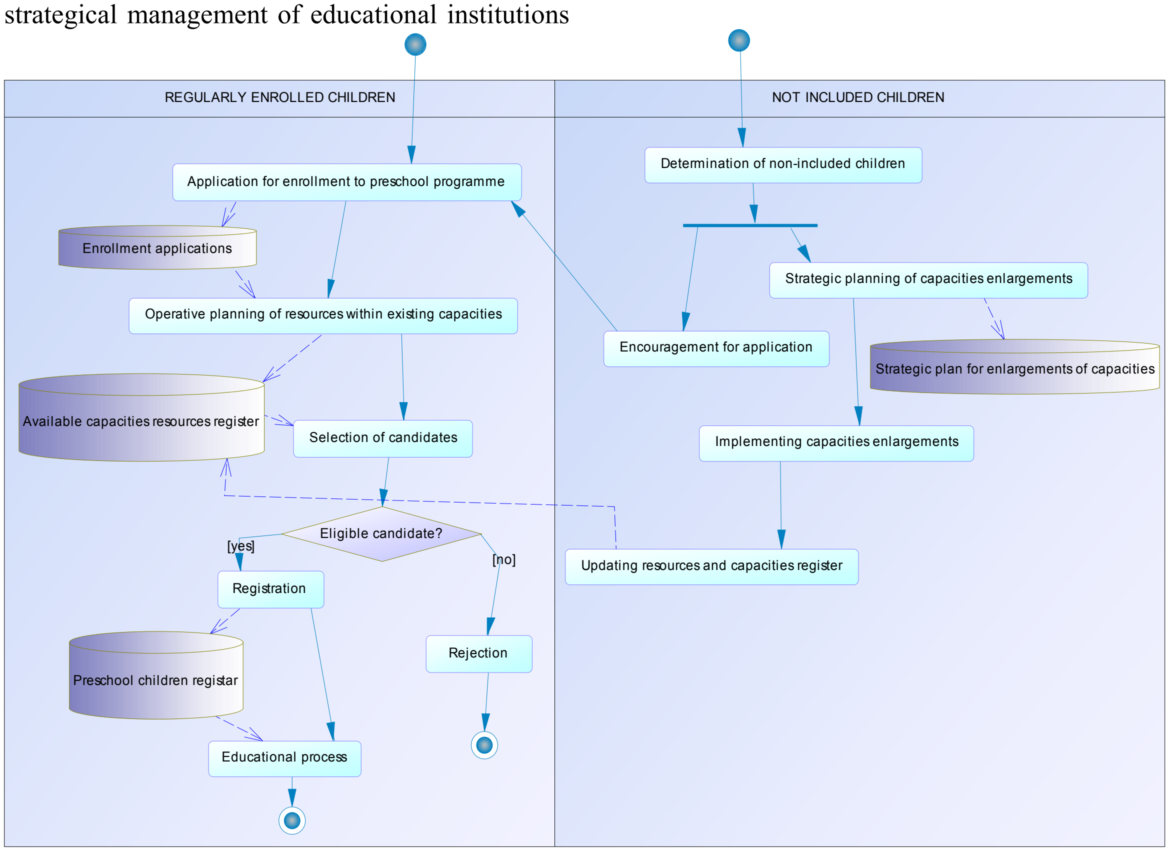

Figure 1 – Business case representation as business process model with regularly enrolled and not included children [10]

V. DESIGN OF THE PROPOSED SOLUTION

Design of the proposed and implemented [3] solution is presented in this section for all four most important aspects.

A. Software structure (architecture)

Software architecture is usually represented with UML component diagram.

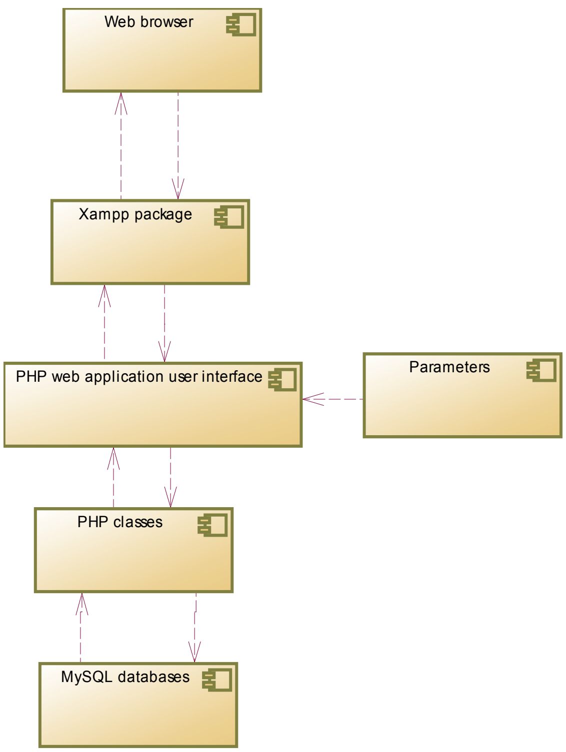

Figure 2. UML component diagram of the solution

UML deployment diagram also gives a good insight of how software components were planned to be organized with nodes of computer network.

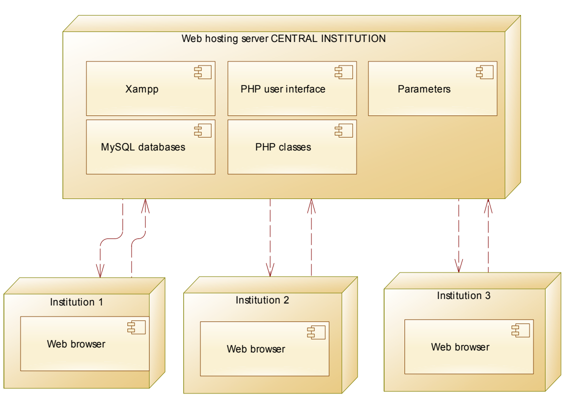

Figure 3. UML deployment diagram of the solution

B. User interface design and user interaction modalities

Graphical design of the user interface is selected to be simple, with static menu at the left part, static banner and footer parts and the main section which will dynamically change, according to menu item selections. Figure 4. presents simple data entry form, figure 5. presents complex data entry form in master-detail relationship between data, while figure 6. presents simple form with tabular data and filtering. More complex forms include computation of data projections (figure 7) and graphical presentation of data (figure 8).

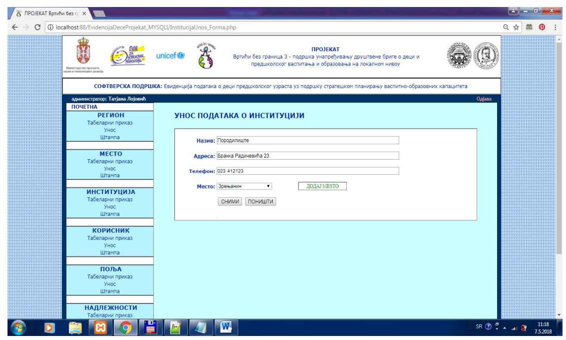

Figure 4. Simple data entry form

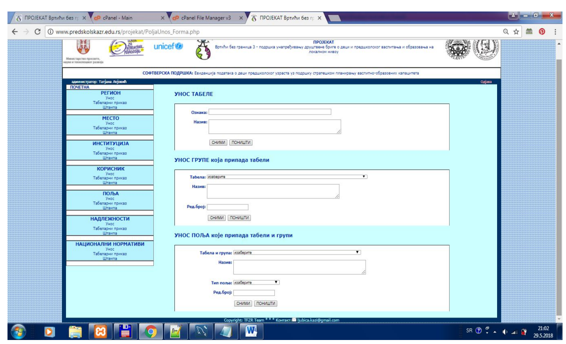

Figure 5. Complex data entry form in master-detail relationship between data

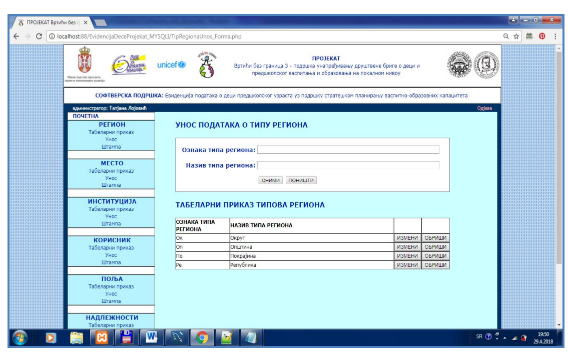

Figure 6. Form for tabular presentation of entered data, with filtering

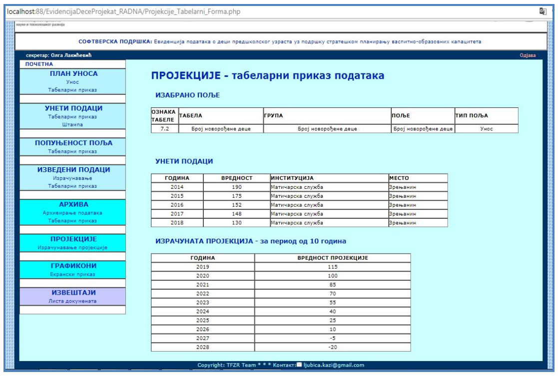

Figure 7. Data projections form

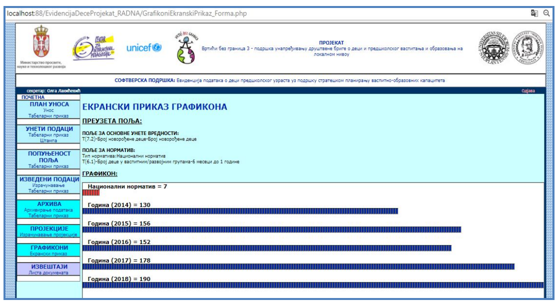

Figure 8. Form for graphical presentation of data

User interaction is selected to be via regular input devices, such as keyboard and mouse.

C. Functional design (behavioral, dynamic view)

The proposed solution is designed to enable several user profiles, with functions such as:
1. *administrator* – provides coding tables data, such as users, institutions, fields, formulas for computation of derived data etc.
2. *institutions representative* – enters data that are assigned to particular institutions, during the data entry time period.
3. *data analyst* – monitors data entry, initiates data archiving, starts derived data computation, analyzes data for predictions, creates reports.

D. Design of information presentation

Information is organized via:

- Textual parameters for adjustment of software functionality.
- Multiple MySQL relational databases. Data structures for entry and assignment to institutions are separated from data entry, in aim to enable flexible solution. Administrator of the system, according to the strategic goal, define data items to be entered from institutions. Administrator assign data items to institutions that are responsible for appropriate data. These meta-data are saved in separate database. Data entry with the data from institutions related to particular time period is saved in another database. There are several databases:
    - Users
    - Software options (menus items)
    - Data items meta data
    - Regions
    - Data entry from institutions
    - Data Archive
    - Data computation formulas

VI. Conclusion

Strategic planning for institutions is particularly important to enable the course of actions for reaching goals that could lead to improvements in institutions and wider region society. Particularly important area of human activities is related to education and providing appropriate resources for educational process is closely related to the quality of education.

This paper presents results of a project aimed to encourage children from vulnerable society groups to be enrolled into the preschool programme, which leads to the need for planning and providing more supporting resources. This project included creating web portal for collecting required data from multiple institutions, computation of collected data, data projections and visual presentation. This paper particularly presented business case and the design aspects of the developed software - software architecture, user interface design, functional design and data organization.

Acknowledgements

This paper represents results of a project "Preschool without Frontiers 3 – support to improvement of social care about preschool-aged children at local level", which was implemented in 2017-2018 year period, by partners: Ministry of education, science and Technology development of Republic of Serbia, UNICEF, CIP center for interactive pedagogy, including results from Technical Faculty "Mihajlo Pupin", Zrenjanin, Serbia created in year 2018.

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The Use of Mobile Applications in Education

A. Ristić*, D. Cvetković**, R. Ristić*
* ES „Kosta Trifković“, Novi Sad, Republic of Serbia
** Faculty of Education, Sombor, Republic of Serbia
aleksandramarkovic@ymail.com, dcveles@gmail.com, radisav@gmail.com

Abstract- The use of technology in education has developed greatly in the 21st century. To that end, the impacts are considered that have been both positive and negative and consider ways that adaptation of technology can be made further efficient to meet the aims its use can bring.

I. INTRODUCTION

Technology has always been a staple of education – be it in for example medical departments, physics departments etc. any degree will confer an opportunity to use technology on a student. However, as technology has developed over across the end of the last century and into the 21st century, the availability of technology has both increased the scope of those who interact with it and this has led to different developments in the uses in education. Within this paper, technology as a weapon to deliver education is examined and a commentary is provided on the state of and future developments likely to be seen in all levels of educational establishment throughout the world. Unforeseen opportunities are linked to developments in tools to deliver positive results in education and the case is made for those and others to be highlighted yet further to enrich study of students around the globe.

II. TYPES OF TECHNOLOGY BEING USED IN SCHOOLS AND UNIVERSITIES

In [1], some research (primarily of medical students) is conducted as to the attitudes towards the use of things such as smart phones and the like around medical education. One premise the authors do not address in their writing is the simplicity of facts – while students can type questions into their device and retrieve a general answer or statement, the issue of a specialized solution or an individual case study is removed. The conclusions are that there are positives and negatives. We will examine some of these in section 3 of this article and look to extend on their work with subject specific technologies being a way to bring together more positives than negatives.

Initially, let us start at school level – almost every school is connected to the web, there are smart boards to impress on visual learners the topics being discussed, there are more videos and audio clips to be used (such as in music lessons) and available at the click of a button, there are participation devices (such as clickers or voting pens for use with a tablet), and so on. Many high schools, for learners between 15-18, have budget constraints but head-teachers and principles in our research have identified technology and the need to cater for wide-ranging learning styles as an essential part of education. The goal is to achieve success, but it must be personalized, with an individual flavour of the best tech being targeted to pupils learning rather than generic.

Almost all teenagers will have some kind of device – laptop, desktop computer, smart phone – which allows a connection to the world-wide web. Schools have adapting (or in the process of adapting) to availability of education. One example given was a student who went on the internet during a class to correct a teacher on the date of a battle in a history class. Kudos to the student for learning that fact, and kudos to the teacher for not detaining the pupil for interrupting, but the point is that the information was available, at the click of a button, to facts but not learning. Concepts such as learning cannot, at present, be programmed and nor should computers replace teachers or other educators but the example of this student brings together a number of realities of the information generation whose appetite for learning is often seen to be low compared with previous generations.

In universities, the problems faced at schools are exponentially multiplied – be it due to the size of student bodies or the like, the issues which technology present are the same. There is no substitute for learning or knowing facts as opposed to retrieving them from some internet website. At present, of the lecturers we spoke with during our research, the consensus was that there must be harmony between the aims of educating and the availability of information. Without such controls, then the use of technology might be misguided and misused as a substitute for substantive learning, which can lead to creativity and intuition which is lacking from the computer at present.

III. AVAILABILITY OF TECHNOLOGYY AND THE AIMS FOR ADOPTING TECHNOLOGY WITHIN EDUCATION

Over time, prices, naturally, drop for certain technologies. Computers today can run programs that 20 years ago would not have been feasible. As such, it is quite easy to confirm that technology is accessible and available to the masses much more than in the recent past. Computers today, in everyone's home, can load up games such as chess which can beat everyone – even the world's greatest players. Similarly, there are technologies available today which bring education to pupils where the teacher doesn't have to be in the room, such as at the Westlake School in Maryland [2]. This shows that technology is wide in its reach and its applications. With a little more digging, two primary questions arise: firstly, what is the point of using technology in education? and, more importantly, what should be the aims of integrating technology in to the classrooms and lecture halls?

The first question can be answered broadly in terms of access – broadening access to education can be facilitated by technology, whether it is providing video conferences of lectures, assisting different learners with the way things are presented, providing more access to education to those with learning difficulties or disabilities, and, just as importantly, to simplify education. These ideals are discussed in [3] and [4]. Without access to technology, Professor Stephen Hawking, the famed physicist who suffers from motor-neuron disease, would be unable to articulate his incredible work in Science, and without access to technology many people would not have ever heard him speak.

The second question is more pertinent and hence less trivial to have a definitive answer. It is clear from our undertakings, that focus and individualized planning for the integration of technology is something almost all involved in education can agree on. The aims must be four-fold:

- *alternative approaches to education;*
- *to provide a stable outlet to enhance learning outcomes;*
- *more efficient and cost effective than alternative approaches; and,*
- *personalized to the needs of the individual student.*

In section 3 we address c), while in section 4 d) is considered. To ensure that a) is achieved, as technology becomes more used in the education setting that it must provide something different otherwise there is no point to its adoption. Responses from many of the schools have highlighted several different applications which have become available in recent years. In the table below we have highlighted some of these and their primary usage in schools and universities.

Often a combination of these (or many of the other types of applications) available will lead to positive engagement with students, parents and other teachers. As long as their adoption in a positive manner, then over the long-term analysis can be made as to whether the aims of b) are being addressed.

It can only be a long-term project which studies the effects of technology on student outcomes, and some research has been undertaken on whether these devices have led to positive results. At the University of Strathclyde, for example, the first UK university which introduced Vote clickers in 1998, there has been analysis which has shown that students are much more interested in interacting as lectures progress. Feeling valued and opinions realized induces psychological, sometimes sub-conscious, engagement with educators and this can lead to more well-rounded students. While the psychology is not something delved in to here, it is obvious that an ancillary benefit is that psychologically motivated people are more likely to be productive.

IV. COST-BENEFIT ANALYSIS (BOTH FOR EDUCATIRS AND STUDENT)

In business, the article [5] provides compelling evidence as to the benefits, including the costs, of an adoption of technology. There can be no doubt that resources being maximized is a goal of good business, and in education to take a similar approach is more likely than not to give similar benefits.

As more and more educational establishments are being run as businesses, there must be a business approach to ensuring that productivity is raised. The measures are creative output, students with better examination scores, higher degree classifications being awarded, more students engaging with further studies (such as PhDs) and this is balanced against the cost of the technology or, more precisely, the cost to the consumer. One school in the UK has purchased an iPad for every 15-year-old to have them use these to organise their work and have, at their fingertips, a gateway to a further raft of resources. As an experiment, the school has confirmed that it will continue this on a running program over 3 or 4 years, refreshing the equipment and getting good deals with suppliers who will have a guaranteed contract which helps their business in a typical cycle.

Of course, not every school will have the funds or feel this is the best place to deploy a set of scarce resources, but as the experiment continues and should further progress in results of students be in evidence, then this type of adoption is likely to become more popular. Some schools will expect parents to have already got the internet and computers and smart-phones for their children, but there should be no barrier to access of education so, without getting political, it is to be hoped that evidence become more available to convince the tech non-adopters to become tech adopters. Given that the cost of technology is so low these days, there must be room found in budgets to allow for this type of interaction, even if it is using free apps to provide something different. Many of the educational apps available are free (especially in their basic form with add-ons available at a cost) that there can be no barrier to entry of the market for tech in education.

V. FUTURE DEVELOPMENTS

Looking at the list in [6], which highlights the benefits of using apps in education, the most important is that apps are organized via systematic learning activation. Without this, many of the apps just become a set of statements and facts jazzed up into an app – convenient, but not inspired. However, those apps on the market which integrate a systematic approach are those which take a journey – from knowing little or nothing to whatever level the app serves (be it high school, university undergraduate or beyond). It is to be encouraged that app developers ensure that this type of approach is undertaken when apps are being launched as educational tools.

72% of universities in the US are currently engaged with some form of Google apps (Table I.) as highlighted above in the table (Google classroom is one of a huge array of Google apps). This growth will continue and integration of technology is inevitable so the best way to influence it is to be proactive in developments and ensure that the aim d) can be achieved. There must be individual programs and apps developed where the app can learn where the holes are in the students' knowledge and then ensure that revision and questions are focused on these areas to help the student progress. Much is being done in this manner, but not all apps "learn" and this area of development is still in the infancy stage. There must be encouragement, perhaps through grants or tax breaks, to ensure that companies involved in the development of these apps will ensure a more personal approach for students. Some in [10] can achieve this aim andmore must be done to encourage a larger percentage of these apps to deliver here.

TABLE I. APPLICATION FOR MOBILE TECHNOLOGY

Application for	Usage
Google Classroom	Engagement with students, grading papers and ensuring distribution of the marks, organization of class materials
Kahoot	Playable "games" based on classroom material uploaded by teacher for students to then "play"
SeeSaw	Application to engage with parents to check on pupil progress
Epic unlimited books for kids	Aimed at getting younger children to engage with reading
Educreations	An interactive white board app to engage both students and teachers
Blackboard mobile learning	Discussion boards and announcements can be sent to students for engagement with class and other invited users
Vote clickers	Hand-held devices which allow students to answer questions in an "ask the audience" fashion

VI. CONCLUSION

[7] and [8] show that consequences are so far mainly positive. Student react well to change and are often more open to trying different things to achieve the maximum potential. There are, and always will be, limitations such as adaptability at present or not knowing the future direction that developers are likely to take technology, but these are outweighed by the positives testified to by students, their parents and education professionals. One educational consultant who responded to our questions, pointed out that a 1% increase in efficiency of students and flexibility of the work-force would lead to economic benefits to a country which governments dream of and that the tools are available, either underused or not known about. The amount of money some educational establishments spend on expensive management information systems is staggering compared to using apps which provide the same functions for a fraction of the cost. Encouragement of schools to uptake must be where this research leads and there is hope that in many countries that adoption and take-up will be growing in the 3 figure percentages over the next 5 years.

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Design and Development of a Game for Recognizing and Expressing Emotions

V. Ivanov, R. Ivanov, N. Koceska
Faculty of Computer Science, University Goce Delcev – Stip, Republic of North Macedonia
ratko.101405@student.ugd.edu.mk; natasa.koceska@ugd.edu.mk

Abstract - Autism Spectrum Disorders (ASDs), a neurodevelopmental disability in children, is one of the major health concern nowadays. In everyday situations, children with ASD encounter problems related with perceiving, understanding and using non-verbal cues as gestures, tone of voice or facial expression. Considering this facts, it is not surprising that the daily social interactions will be a problem for them. Conventional methods for treating children with ASD such as pharmacotherapy, special education and behavioral therapy, are not always successful and are usually expensive. There is a notable need to develop technology-based methods which will act as a supplement to the traditional ones, in order to make them more effective. *CatchMyEmotion* is an interactive game designed to measure the perceptual skills that are implicated in the recognition of facial emotions. It is designed and developed to promote emotional understanding, and to enhance facial and emotional recognition skills in children with ASD.

I. INTRODUCTION

Nowadays, it is hard to find a child who does not play and like computer games. They have been used for both learning and entertaining purposes at home and schools. Games are especially attractive for children with ASD, due to the visual nature of screen-based technology, the design and immediate feedback that they provide [1, 2, 3]. Playing games also helps them to practice flexible thinking, to become more comfortable after making mistakes and to recognize the importance of practice in order to improve skills.

Over the past years, great efforts have been made to teach children with ASD to improve their skills, especially recognizing and expressing emotions. Research shows that children with ASD have deficits in recognizing emotions and responding appropriately to non-verbal affective displays, which affects social development and reduce the probability of successful interactions [4, 5, 6, 7, 8]. Various interventions that aim to improve affective behavior and emotion expression of ASD children are recognized nowadays: developmental approach (relied on interactive tools), behavioral approach (based on Applied Behavior Analysis (ABA) and affect training [9]. Apart from these traditional interventions, there is a new approach to use modern technology aimed to develop computer games which can be used to teach children with ASD various social and communicational skills.

The computer game Let´s Face It [10] is an example of this new approach. It is designed to teach face processing skills to children with autism spectrum disorders and children with specialized learning needs. The game is organized in a theoretical hierarchy, in 3 Domains, which reinforce child's ability to attend to faces and understand facial structure, to recognize facial identity and facial expressions and to interpret the social meaning of these facial cues. Another similar application is LifeIsGame [11], designed to teach children with ASD to recognize facial emotions, using real-time automatic facial expression analysis and virtual character synthesis. The game uses avatars to recognize, create or mimic the emotion expression of a human. Another application that uses virtual humans (avatars), to teach emotion recognition to children, is cMotion [12]. By introducing avatars, cMotion hopes to increase users gaming motivation and thereby their ability to learn. EMot-iCan [13] is a game that tests the theory that atypical attention patterns are at the root of several of the features that characterize ASD. These features include impaired social and communicative skills, difficulty in adapting to changing environments, and academic underachievement. SmileMaze [14] is a training program developed with the aim to improve the expression production skills of children with ASD. The goal of the exercise is to successfully navigate a maze while collecting as many candies as possible. The player controls the character using the keyboard for navigation. Facial expressions, which are automatically detected using a standard web-cam video stream, are used to move the obstacles at various points within the maze. Emotiplay [15] is an interactive and intrinsically motivating online game, aiming to teach children to recognize emotions from facial expressions, vocal intonation, body language, and their integration. This game was designed and evaluated as part of a large-scale European project (ASC-Inclusion), which explored technological ways to improve the inclusion of children with ASD. Mind-Reading [16], although not strictly a game, is an interactive program, designed to teach children with ASD about complex emotions. It is based on taxonomic system of 412 emotions and mental states, clustered in 24 emotion groups and 6 developmental levels from 4 years to old adulthood. Using this software over a period of 10-15 weeks improves the child's ability to recognize complex emotions and mental states from both faces and voice.

II. Technology Based Methods

According to Ekman [17] there are six basic emotions that are universally recognized from facial expressions by all human beings, regardless of their culture. These are: joy, anger, surprise, disgust, fear and sadness. The most often emotions used by researchers are: fear, happiness, anger, sadness and surprise [18–21], because they can be recognized with great accuracy. However, there are studies that used some additional emotions like: neutral and contempt [22, 23].

Different sensors are used to capture these facial expressions. The most often used is the camera that records the face of a person. Face expressions are recognized from two-dimensional (2D) or three-dimensional (3D) space [24, 25, 26]. Various methods are applied to recognize the basic expressions in 2D and 3D spaces. However, the landmarks localization processes are used both in 2D and 3D data.

In our work we used 3D data captured with a standard web camera. Since this is the first prototype of the game, we implemented only the following expressions: happines, surprise and sadness. In a future versions, we plan to introduce the other basic emotions.

The game is developed in Unity3D [27], using the Affectiva SDK [28] for detecting emotions in real time. The Affectiva technology is designed to analyze spontaneous facial expressions that people show in their daily interactions. Computer vision algorithms identify key landmarks on the face such as: the corners of the eyebrows, the corners of the mouth, the tip of the nose etc. Then the machine learning algorithms are used to analyze the pixels in those regions and to classify facial expressions. Emotion classification is made using the Facial Action Coding System (FACS). FACS is a system to taxonomize human facial movements by their appearance on the face. It refers to a set of facial muscle movements that correspond to a displayed emotion. Originally created by Carl-Herman Hjortsjö in 1970 [29], it was subsequently developed further by Paul Ekman, and Wallace Friesen [30]. Their version was first published in 1978, and later updated in 2002. Using FACS it is possible to code nearly any anatomically possible facial expression and deconstructing it into the specific Action Units (AU) that produced the expression.

III. Architecture

Standard computer games are created using a simple feedback loop, where the inputs are usually a mouse or/and a keyboard while the output is provided through a monitor and/or audio speakers (Fig. 1 (a)). The game, presented in this paper, has a slightly different feedback loop which provides additional interactivity (Fig. 1 (b)).

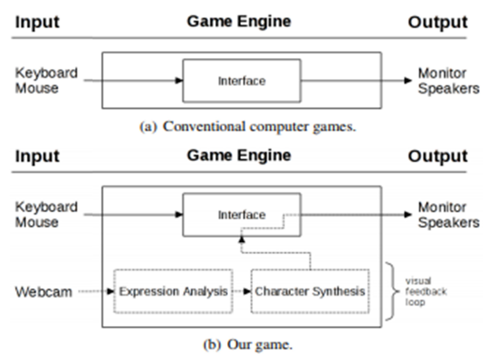

Figure 1. Comparison between conventional computer game loop and our

As it can be seen from the picture, the visual input from the player is continuously and automatically acquired by web camera. This additional input brings the interaction between human and computer to a level which is unattainable for the standard games. It also allows a design of advanced interactive games.

IV. Game development

The process of game development can be divided into several phases:

1. Development of the idea – this is the initial phase of game development in which the theme and the purpose of the game are selected.
2. Design of the game:
    a. Object modeling – various models of objects are created in this phase.
    b. Map modeling – the map and the environment in which the action takes place, is created.

3. Coding – this phase is specific for every type of game. In this phase the parameters of the physics for movement and control of objects are being set. All other necessary scripts are also created at this stage.
4. Testing – in this phase, user usability (especially in prototype development), playability and the efficacy in the learning process is evaluated.

A. The idea

In order to start the game development, it is necessary to develop an idea first. The games should attract the attention of the players, and force them to compete and improve. In particular, games designed for children with ASD should be fun and easy to use on the one hand, but also very motivating on the other hand, to keep their attention.

Having in mind the social interaction and communication problems that children with ASD face, we decided to develop a game in order to help them overcome these problems. CatchMyEmotion is an interactive game developed to help the emotional development of children with autism.

B. Game design

The design process determines the content of the game and the way in which the user feedback will be realized. During this process, individual elements of the game, the scene, the objects of interaction and the user interface are also created.

CatchMyEmotion consists of several levels in which the player needs to collect the emotional balls that are on the scene. The number of balls increases with each level. The first screen introduces the game, and explains how it is played. Each level of the game has a different scene that represents the environment of the playing field. During the game, the user's emotion is captured in real-time using a standard webcam. The goal of this game is to collect as many emotion balls as possible in one minute. If all the balls are collected by the user, the game goes to the next level. On each level a new emotion is presented, i.e. emotional ball with new emotion appears on the playing field. This motivates children and "force" them to learn new emotions so they can go to the next level. The feedback is delivered through audio, text and images. When a player collects a ball he/she receives a positive feedback through a sound. At the end of each level, the total number of collected balls is displayed on the screen.

C. Main character

Every game consists of objects. Whether they will be 2D or 3Dobject, depends of the designer's idea. In this game 3D objects that fit into the design of a game are used. The main object is a character presented on the following picture (Fig.2), which is taken from the standard asset of Unity. Through it, the player actually transfers his emotion in the game.

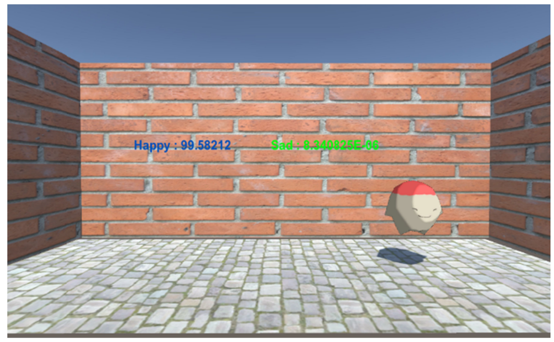

Figure 2. The main character in the game

The emotions of the player are detected through the web camera, and then processed by a computer program and displayed on the screen. The keyboard arrows (left, right, up and down) are used for navigation of the main character. To collect a ball, the player need to move the character to the desired ball and to express the emotion that is on the ball. For example, if the ball is with smile, then the player need to move the character to touch the ball and make a smile face. The emotion will be detected by the camera, and if it fits with that of the ball, then the ball is collected, and the player's score increases.

D. Emotion balls

Emotion balls are different kind of 3D objects which appear in the game (Fig. 3). They are used for showing different kind of emotions which the player should imitate. In this way the player learns to recognize different emotions and to express them.

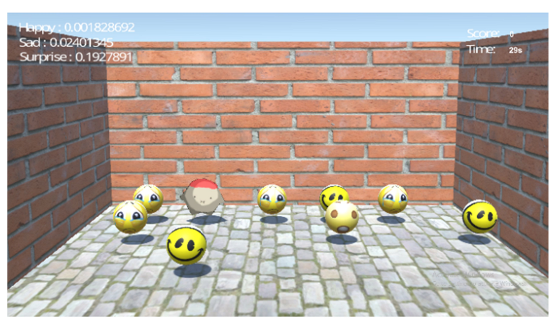

Figure 3. Level of the developed game

V. CONCLUSION

Information and communication technologies (ICTs) offers new perspectives in therapy of ASD children, who are facing various problems related to social interaction and communication. Children with ASD often find it hard to recognize facial expressions and the emotions behind them, as well as to copy and use emotional expressions. In this content, interactive games can be used as a tool to support traditional therapy for children with ASD, in order to improve their affective skills. The ability to accurately perceive, interpret and express emotions is fundamental to effective social communication.

In this study we have presented the design and development of an interactive game called *CatchMyEmotion* that teaches children with ASD to recognize and mimic emotions from facial expressions. The game employed various elements aimed to enhance users' motivation to play and to increase learning effectiveness.

CatchMyEmotion is primarily developed for home use by children with ASD and their families, but that does not mean that it cannot be used by others. However, in order to be used for therapeutic purposes, an evaluation should be carried out and results for the therapeutic relevance of this game should be provided.

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A Preliminary Review Teaching Computer Graphics at University

S. Mihajlović, I. Berković, A. Stojkov
Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
mihajlovicsinisa25@gmail.com, ivana.berkovic62@gmail.com, sahskica.s@gmail.com

Abstract – In this paper presents an overview of the representation of Computer Graphics at Universities around the world. Computer Graphics has a great application and is very popular among students. There are various methods of teaching.

I. INTRODUCTION

Computer Graphics is very popular and important discipline. Computer Graphics is discipline built on a strong mathematical basis. Computer Graphics occupies an important place in Computer Science. The results of Computer Graphics are visual and therefore interesting. Attracts students and gives them knowledge about the algorithms used to create graphics applications. The Computer Graphics curriculum focuses on Information Technology, Software Engineering, and Computer Science [1].

With new knowledge Computer Graphics is a very active field. The introductory course of Computer Graphics represents an exciting are for students. In this way, talented students are attracted to this area. Computer Graphics uses new knowledge that is published daily. Continuous progress in this area must introduce new things in the curriculum. In computer graphics as professors and teachers, it strives to balance the more practical approach and theoretical perspective. The most important question is which content is taught and used in Computer Graphics [2].

The availability and the use of computer graphics as a basic technology represents the natural evolution of the graphical representation methods and tools. Students who choose Computer Graphics also get knowledge in mathematics [3]. As engineers in the past used a calculator, today's graduated engineer should be trained to use computers and Computer Graphics as a design tool. In order to increase their total productivity, more and more companies enter large amounts of money in Computer Graphics and systems for designing and computing. Educational institutions must follow the trend and empower students with new technology [4]. Computer Graphics are suitable for multimedia applications [5].

II. LITERATURE REVIEW

Students who choose Computer Graphics at the University of Coimbra must attend in three main areas: mathematics, computer science and Computer Graphics [3]. Students of Computer Science are the target group for the education of Computer Graphics. Forms of instruction in Computer Graphics at German Universities are lectures, seminars, practical trainings and projects. In some departments, project work in workgroups can prevail, while at other regular lectures. There is a wide choice of subjects to be taught, curricula and programs in various institutions are certainly influenced by the appropriate teachers [6].

In 1983, it was recognized the importance of teaching when James Foley, discussed the practices in the curriculum in the initial field of computer graphics [7]. Given the lack of Computer Graphics, 1986 Ohlson advocated for a stronger position of Computer Graphics in Computer Science [8]. Applications in the field of Computer Graphics use graphic interfaces. Such programs enable interactivity with students and enable students to learn by watching. Dino Schweitzer has developed a series of programs related to two-dimensional graphics. His programs were among the first to interact with the program [9].

The curriculum at the University of Lowell Computer Science Department is emphasized on Computer Graphics with a computer graphic laboratory. Their work is reduced to GKS, CGI, X windows and PHIGS+ [10]. Interest in Computer Graphics increased with the introduction of OpenGL in the late 90s and early 2000s [11]. The Bologna process has defined that universities must have at least one Computer Graphics course required for graduation [12].

Figure 1 illustrates example of computer-generated imagery (CGI).

Figure 1. Example of computer-generated imagery [25]

OpenGL requires more advanced programming. This defect was introduced by the Processing language at the Polytechnical University of Valencia [13] and at the United States Air Force Academy [14]. The emergence of GPU programming has come up with proposals for the introduction of shader-based Computer Graphics begun by Angel and Shreiner [15]. Due to the need for OpenGL programming Fink, Weber and Wimmer introduced Computer Graphics to the Vienna University of Technology. Students are guided through program assignments and lessons [16].

At the University of Stuttgart there is an introductory course of Graphical-Interactive Systems at the third year of Computer Science studies. The content of this subject covers the area of Human-Computer Interaction and Computer Graphics. Usually these courses are taught separately, but at the University of Stuttgart they believe that they have much in common. The length of the course is one semester. Prerequisites are knowledge of mathematics, as well as the basics of programming language such as C, C++, or Java. The goal is to understand the basic concepts of HCI and CG from the level of the device to the application level. Students use APIs OpenGL and Qt together with C++. Students have homework for which they need about two hours. The course is usually attended by 40-100 students, and mainly from software engineering or information technology, but there are also students who choose it as an elective subject [17].

Figure 2 illustrates running an OpenGL program.

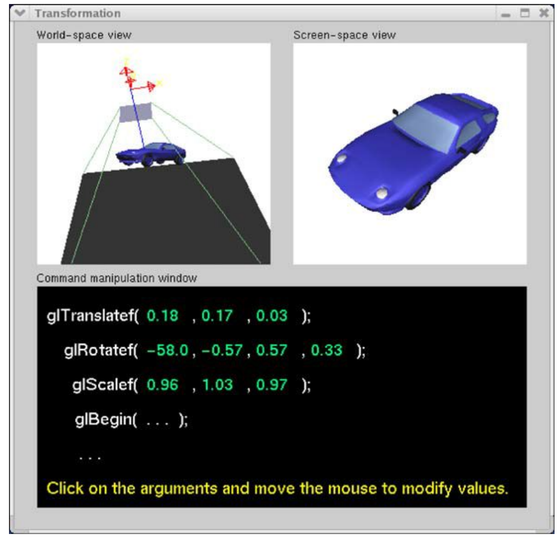

Figure 2. Running an OpenGL program [24]

Students who want to focus on computer graphics need to develop a visual meaning. Visual analysis requires minimal time in the classroom. Students learn to identify surface algorithms, shaders, and lighting techniques. There is an interactive software package for TERA (Tool for Exploring Rendering Algorithms) and has a million image combinations. This software enables students to practice visual identity skills and thus become better developers [18]. TERA is an interactive tool that facilitates a comparative study of visual effects to rendering algorithms. Students can choose a scene and a specific rendering algorithm for an object on the scene. Students are testing themselves, TERA generates a scene, and students have to guess which rendering algorithm is applied to the object in the scene [19].

Figure 3 illustrates an example in the TERA software.

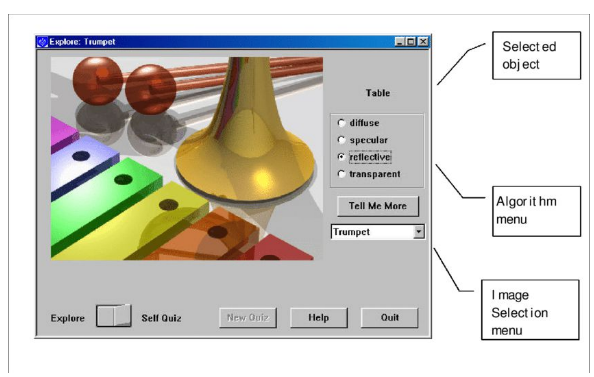

Figure 3. TERA software [20]

At the Royal Institute of Technology, OpenGL is used in the introductory course of Computer Graphics. Basic lesson and principles are presented at GLUT, and in addition there are lectures describing the graphic hardware and functionality of OpenGL. Students get the assignment they need to use OpenGL. Constructive learning was introduced, replacing a few lessons with OpenGL. Students are presented with a problem, after which they can talk to him and finally find a solution [21].

Computer graphics has progressed, and obviously becomes compulsory in education. Education in computer graphics requires laboratory practice, and so on at the New University of Lisbon. Students develop some tasks, and the level of weight depends on the course they attend: basic or advanced. Problems that are being suggested to students are a mixture between an algorithmic and a project-oriented task [22].

There is an innovative and creative program at the University of Gavle, Sweden, which combines traditional methods of teaching computer graphics with art and film. Students have accepted the environment in which the classes are held. It makes the group from a professional artist to a computer scientist. Part of the time is spent in the laboratory, and the other in the industry. The results are very satisfactory [23].

Figure 4 illustrates experiments with lighting and reflection using the tools available in the labs.

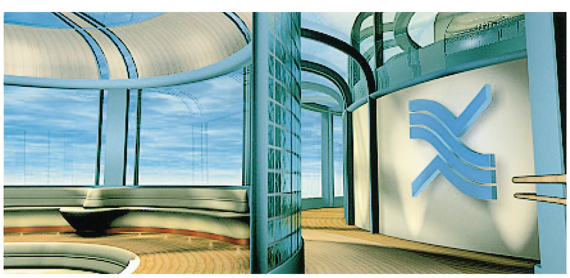

Figure 4. An animation showing the future dental clinic [23]

III. COMPARISON

One of the common characteristics of the curriculum is that students who listen to Computer Graphics must have good knowledge of mathematics. The course length is one semester. It is mostly attended by students of software engineering, information technology, and students who choose it as an elective subject. OpenGl is used for programming in lectures. Students' interest is great because Computer Graphics provides interaction.

Curriculum differences are that Computer Graphics are taught at some faculties as an introductory course, while others teach as a more advanced course. The structure of the course depends on the faculty. Professors have the ability to teach the subject how they want. The teaching method depends on the professor as well as on his expertise. Some professors introduce innovation in teaching, while some professor combine the subject of Computer Graphics with other subjects such as Human-Computer Interaction and the like.

IV. CONCLUSION

At individual Universities are presented methods of teaching Computer Graphics. The way it will be taught depends on the curriculum, but the most professed subject depends on the subject professor. The professor can animate students in various way, apply existing methods, or use some new one.

Computer Graphics has been used throughout the world for a long time. Therefore, it is necessary to have more and more graduates from the field of Computer Graphics. Computer Graphics follows trends and uses new technologies that students need when they graduate and must be ready to work in the industry.

ACKNOWLEDGMENT

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Teaching Basics of Serial Robot Chains's Kinematics to Computer Science Students

K. Davcev*, N. Koceska*, S. Koceski*
* University Goce Delcev – Stip/Faculty of Computer Science, Stip, Republic of North Macedonia
saso.koceski@ugd.edu.mk

Abstract - Understanding the geometry, kinematics and dynamics of serial robot chains using for computer science students is very challenging task. Therefore, adopting the corresponding methodology for teaching robotics in the undergraduate program is very important. Main goal of this paper is to validate the adopted approach to teach the kinematics of serial robot chains using virtual environments and physical humanoid robot. Moreover, the concept of visual programming of serial robotics chains vs. classical programming has also been evaluated.

I. INTRODUCTION

Technological advancements in the last couple of decades have contributed to robots' penetration in multiple sectors and have made them affordable and applicable even for personal usage. This is a result not only on miniaturization of the hardware components and their low prices but, also due to the development of novel control paradigms as well as development of Artificial Intelligence (AI). The growing popularity of the Artificial Intelligence (AI) and its application in various fields [1], starting from tourism [2], through medicine [3-5], biology [6], education [7], robotics [8-11], and also in economy [12], is mainly due to the apparatus i.e. the models and techniques used to mimic the human reasoning, learn and improve during time.

Research funds, crowd-funding platforms but, also commercials and news headlines are also an important indicator of the rising popularity of robotics in the recent years. Fifty years ago, almost nobody believed that humanoid robots, like Rosey the Robot Maid in the Jetsons animated series, may become true.

Nowadays, we can find multiple robot systems that have significant level of intelligence, used in our daily life. Examples include autonomous cars or unmanned aerial vehicles, various service robot systems, smart home appliances such as air-conditioning systems, automatic vacuum cleaners and many more.

The fact that our life is becoming more and more "robotized" as well as the possibilities to develop smart systems that may contribute to improve human live, is inspiring more and more students to gain knowledge and become robotics specialists.

As educators the first problem we have to face is to raise the awareness and change the students' attitude towards the technology.

Namely, being surrounded with technology since they are born, our students rarely perform a deeper analysis of its working principles. They often treat the technological devices as disposables without even considering the fact that they can be fixed upon failure. As a consequence, if we like to create active thinkers instead of passive users we should change and improve our education programs not only in high school but, also at the university level.

The course Fundamentals of Robotics, is part of the bachelor's curriculum at the Faculty of Computer Science at the University Goce Delcev in Stip, for more than 5 years.

Students tend to find Robotics very attractive, but they are also aware that it is a multidisciplinary area combining elements of physics, mechanics, electronics, and mathematics.

Our past experience shown that students often choose this subject in order to "play" with robots, disregarding that certain important concepts of Robotics require mechanical, mathematical or geometric background which they sometimes find troublesome.

One of the topics that are not so intuitive to be explained and to be perceived by the students are the concepts of forward [13,14] and inverse kinematics [15–17], which define the physical behavior of serial robotic chains. Solving kinematics problems requires knowledge from linear algebra, coordinate transformations, fundamentals of mechanics and a good spatial perception of the 3D movements that occur to the joints of the robots.

Understanding the geometry, kinematics and dynamics of serial robot chains using only written teaching resources can be very difficult for computer science students. Therefore, in the framework of this course we are complimenting the textbooks and ex-cathedra teaching methods with dedicated learning/teaching software that enables the students to easily create, visualize, and simulate the model of a robot in the CAD environment and spent more time to understanding its kinematics. It would also allow the course teacher to demonstrate the concepts and the robot motion in a classroom setup more conveniently. Lab exercises with physical humanoid robot are also part of the teaching methodology.

Main goal of this paper is to validate the adopted approach to teach the kinematics of serial robot chains using virtual environments and physical humanoid robot. Moreover, the concept of visual programming of serial robotics chains vs. classical programming has also been evaluated.

II. Basics of Robot Kinematics

Serial robot chains are designed as a series of links connected by motor-actuated joints that extend from the origin to an end-effector. The joints can either be very simple, such as a revolute joint or a prismatic joint, or else they can be more complex, such as a ball and socket joint. Serial robot chains are integral part of various types of robot systems, from industrial to service robots. Therefore, solving the problem of direct (or forward) kinematics and the problem of inverse kinematics is fundamental for their control and application.

The forward kinematics problem is concerned with the relationship between the individual joints of the robot manipulator and the position and orientation of the tool or end-effector. Stated more formally, the forward kinematics problem is to determine the position and orientation of the end-effector, given the values for the joint variables of the robot.

The joint variables are the angles between the links in the case of revolute or rotational joints, and the link extension in the case of prismatic or sliding joints. The forward kinematics problem is to be contrasted with the inverse kinematics problem, which is concerned with determining values for the joint variables that achieve a desired position and orientation for the end-effector of the robot.

A. *Forward kinematics*

The kinematic analysis of an n-link manipulator can be extremely complex and usage of some conventions can significantly simplify the analysis and contribute towards building a universal language by the means of which engineers can communicate.

A serial robot chain with n joints will have n + 1 links, since each joint connects two links.

The joints are usually marked with numbers from 1 to n, and the links from 0 to n, starting from the origin. Using this convention, one may say that the joint i connects link $i - 1$ to link i. It can be also assumed that the location of joint i is fixed with respect to link $i - 1$. When joint i is actuated, link i moves. Therefore, link 0 (the first link) is fixed, and does not move when the joints are actuated. Of course the robot chain could itself be mobile (e.g., it could be mounted on a mobile platform or on an autonomous vehicle), but this case becomes trivial for explanation if the logic is well understood.

In the 1950s, Denavit and Hartenberg [18] used screw theory to prove that the most compact representation of a general transformation between two robot joints required four parameters.

These are now known as the Denavit and Hartenberg parameters (D–H parameters) and they are the de-facto standard for describing the geometry of a robot [19]:

1. Perpendicular distance between two joint axes, measured along the x axis.
2. Relative twist between two joint axes, measured about their mutual perpendicular vector.
3. Distance between the perpendicular vectors of two joints, measured along the axis of the first one.
4. Joint angle between the perpendicular vectors of two joints, measured about the z axis.

In practical terms, these four parameters can be re-described using the local axes of two

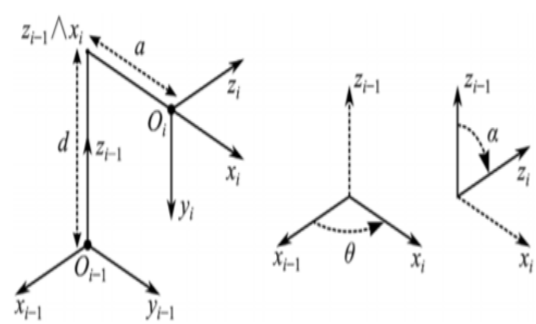

Figure 1. *Denavit – Hartenberg parameters*

neighboring joints or interest points.

Be vectors x_i and z_i the local x and z directions of the i^{th} joint, located at position O_i; vectors and x_{i-1} and z_{i-1} those of the previous joint, located at O_{i-1}; and $z_{i-1} \wedge x_i$ the intersection point between vectors z_{i-1} and x_i (Fig. 1), the D–H parameters can be summarized as follows:

- Distance from O_{i-1} to $z_{i-1} \wedge x_i$, measured along z_{i-1}.
- Relative twist from x_{i-1} to x_i, measured about z_{i-1}.
- Distance from $z_{i-1} \wedge x_i$ to O_i, measured along x_i.
- Relative twist from z_{i-1} to z_i, measured about x_i.

Students are encouraged to use the "right hand rule" in order to figure out the sign of the twist parameters: By placing the thumb of their right hand in the direction of the rotation vector, angles α and θ will be positive only if they correspond to the angle in which fingers curl. For instance, on Figure 1, θ would be positive and α would be negative.

Auxiliary coordinate axes simplify exercises at the expense of increasing the amount of required calculations. Students are often allowed to make their own decision regarding how to solve incompatibility situations, since both axis rearrangement and auxiliary axes are equally valid approaches and produce equivalent results.

Once the D–H parameters have been calculated, the forward kinematics problem can be solved by transforming the joint reference systems, from the base of the robot to the end effector, through geometric transformation matrices:

$$^{i-1}T_i = \begin{bmatrix} \cos(\theta_i) & -\cos(\alpha_i)\sin(\theta_i) & \sin(\alpha_i)\sin(\theta_i) & a_i\cos(\theta_i) \\ \sin(\theta_i) & \cos(\alpha_i)\cos(\theta_i) & -\sin(\alpha_i)\cos(\theta_i) & a_i\sin(\theta_i) \\ 0 & \sin(\alpha_i) & \cos(\alpha_i) & d_i \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (1)$$

defines the translation and rotation from joint i to joint i-1. Be O_N the hypothetical joint located at the end effector, its homogeneous spatial coordinates relative to the robot basis (i.e., joint O_0) can be calculated as:

$$^{0}T_N \bullet O_N = \left(\prod_{i=1}^{N} {}^{i-1}T_i\right) \bullet \begin{bmatrix} 0 & 0 & 0 & 1 \end{bmatrix}^T \quad (2)$$

since $^{i}T_j \cdot {}^{j}T_k = {}^{i}T_k$ and the homogeneous coordinates of any spatial point relative to itself are always $[0,0,0,1]^T$.

The spatial coordinates of every point O_i of a robot chain can be calculated in the same way, by multiplying all the transformation matrices up to said point, times the homogeneous zero coordinates.

B. Inverse kinematics

The general problem of inverse kinematics can be stated as follows. Given a 4 × 4 homogeneous transformation:

$$H = \begin{bmatrix} R & o \\ 0 & 1 \end{bmatrix} \in SE(3) \quad (3)$$

with R ∈ SO(3), find (one or all) solutions of the equation

$$T_o^1(q_1, q_2, \ldots q_n) = H \quad (4)$$

Where

$$T_o^1(q_1, q_2, \ldots q_n) = A_1(q_1)A_2(q_2)\ldots A_n(q_n) \quad (5)$$

Here, H represents the desired position and orientation of the end-effector, and our task is to find the values for the joint variables $q_1, \ldots, q_n$ so that $T_o^1(q_1, q_2, \ldots q_n) = H$.

Unlike forward kinematics problem which has a unique solution, inverse kinematics problem of a typical serial robot chain is not straight forward, mainly, owing to the existence of multiple solutions of the highly non-linear trigonometric functions. While the forward kinematics has a generic procedure for all robot architectures, there is no generic inverse kinematics solution possible that can accommodate all robot architectures.

One has to resort to a numerical algorithm for the solution of corresponding kinematic constraint equations. To obtain solutions to the inverse kinematics problem, one is required to solve multiple multivariate transcendental equations. Sometimes no solution may exist for a given input pose. Such aspects make the topic of inverse kinematics relatively difficult in an introductory course on robotics.

III. Methodological Approach

The topic dedicated to kinematics of serial robot chains is part of the course Fundamentals of robotics subject, during the fourth year of the Computer Engineering and Technology Degree. This subject has been scheduled to cover six credits, according to the European Credit Transfer and Accumulation System (ECTS), which correspond to 156 work hours. This load is divided into three ECTS theory credits and three ECTS laboratory credits.

During the lecture hours, students are introduced to the theoretical and mathematical aspects as well as with robot programming aspects. During laboratory hours, the students are taught how to program and control physical robots using standard and visual programming environments. Moreover, laboratory exercises promote the development of teamwork skills and favor the voluntary formation of work groups inside and outside the classroom.

In order to facilitate the solution of the direct and inverse kinematics problems they were first explained by simulation using RoboAnalyzer 3D simulation environment [20]. This way the students were able to overcome various constraints such as: limited number of physical robots, capability to test and experiment for a limited and fixed number of hours and only during working days etc.

This simulation environment also helps students to:

- build any type of serial-link manipulator and visualize it in 3D.
- change the position and orientation of the joints of the robot through the use of sliders, which helps them to improve their ability of understanding orientation and positioning in 3D spaces.
- change the orientation of different reference frames associated to each joint, which helps them calculate Denavit–Hartenberg related parameters.

Since the inverse kinematics of a serial robot chain, depends heavily on the 3D structure of the robot, and is therefore extremely difficult to automatize simulation models with an architecture similar to the humanoid limbs were created and analyzed in RoboAnalyzer.

Once the basic kinematics concepts were understood, all student team were asked to apply this knowledge on humanoid robot limbs.

For this purpose, the humanoid robot Alpha 1S (Figure 2) was used. The robot is made of Aluminum alloy structure with ABS housing, it weighs 1.65kg, and has dimensions of: 401*198*124mm.

The robot was programmed via Bluetooth protocol using standard programming environment as well as using custom visual programming environment (Figure 3).

Visual programming interface is also offering a possibility to have a 3D preview of the actions performed by code sequences designed by the programmer.

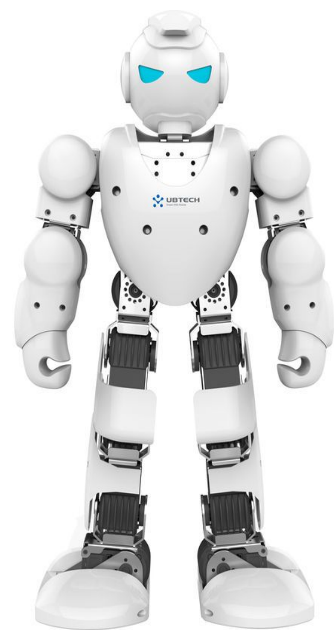

Figure 2. *Alpha 1s humanoid robot*

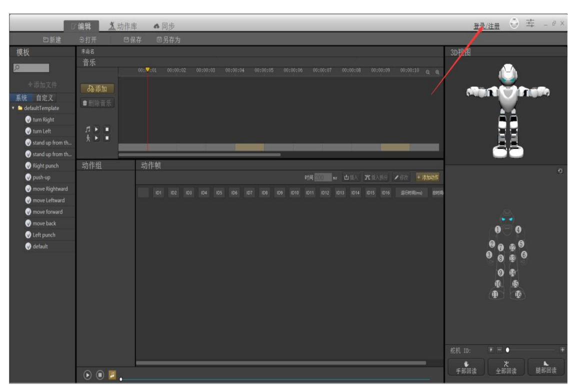

Figure 3. *Visual programming environment*

IV. Evaluation

At the end of the semester students were asked to perform two types of tasks with the humanoid robot: first one was to calculate the position of the end effectors of humanoid limbs for a given configuration of its joints i.e. a task that corresponds to the forward kinematics problem, and the second task was to calculate the configuration of various joints of humanoid robot limbs in a way that their end effectors will be positioned in a specific point.

All 10 student groups, composed of 3 members have successfully completed both tasks. They were asked to respond to a set of questions related to the course methodology.

Each student gave a mark to each of the questions, from 0 (fully disagree), 1 (disagree), 2 (agree) and 3 (fully agree). The mean result obtained at each of the questions together with the related standard deviation are presented in the Table 1.

Figure 4. *Group of students at the Faculty of Computer Science, University Goce Delcev Stip during their laboratory excersises*

TABLE I. EVALUATION QUESTIONS AND ANSWER RESULTS

No	**Evaluation questionnaire**		
	Question	***Answer avg.***	***STD***
1	Do you regard the humanoid as a useful tool to understand the direct/inverse kinematics of serial robotic mechanisms?	4.1	0.99
2	Do you find the development environment easy to use?	4.7	0.60
3	Do you find the graphical capabilities of the development environemnt useful to understand the direct and inverse kinematic problem?	3.6	0.88
4	Do you find the videos enclosed in the laboratory sessions helpful to accomplish the tasks?	4.8	0.48
5	Do you find the documents that come along each laboratory session helpful to understand the practical sessions?	4.8	0.48
6	In general, do you think that the humanoid robot has helped you to understand the concepts explained during theory lessons?	4.1	0.62
7	Do you find the course organization approriate?	4.7	0.60
8	Would you recommend this course to future students?	4.8	0.5

V. CONCLUSION

Main goal of this paper is to validate the adopted approach to teach the kinematics of serial robot chains using virtual environments and physical humanoid robot. Moreover, the concept of visual programming of serial robotics chains vs. classical programming has also been evaluated.

The results of the evaluation showed that methodological approach of the course is appropriate and that the course is very exciting for students. Further discussions with students revealed the fact that motivation tasks and team-working were very inspiring and useful.

Using humanoids to teach direct and inverse kinematics was also considered a good approach. Students preferred to use the visual oriented development environment in contrast to the traditional one for their projects. However, their main concern was regarding the graphical user interface of the development environment. This was mainly due to its very complex structure and it was marked as not user-friendly by the students.

In summary, the fact that the students would recommend this course to their younger colleagues is a sort of justification of the methodological approach.

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Human Resources Evidence and Management Software's

A. Krstev*, D. Krstev**, B. Krstev***, G Milosevski***
*Faculty of Computer Science - Goce Delchev University, Stip, Republic of Macedonia
**Faculty of Mechanical Engineering - Saints Cyril and Methodius University, Skopje, R. of Macedonia
***Faculty of Natural and Technical Sciences - Goce Delchev University, Stip, Republic of Macedonia
aleksandar.krstev@ugd.edu.mk, boris.krstev@ugd.edu.mk

Abstract - Human resource records include all the activities that managers undertake to attract and retain employees and ensure that they perform high-level work and contribute to the achievement of organizational goals. These activities shape the organization's human resources management system, a system that has five main components: management and selection, training and development, upgrading of work and feedback, salary and benefits and employee relations. Human resource record is the process by which managers design the components of the human resource management system that are mutually consistent, with other elements in the organizational architecture and with the organization's strategy and goals. The purpose of human resources records is to build a human resource management system that promotes the efficiency, quality and innovation of the organization and the needs of consumers - four carrier blocks of competitive advantage. The human resource record and management software is divided into several modules: systematization, management and selection, personal records freelance cooperation, records of employees' documents, career, absences, performance measurement and reviews.

I. Introduction

The term human resources are used to explain the individuals who constitute the workforce of an organization. In addition, this notion also applies to the economy of labor, for example, business sectors and even whole nations. HR is also the name for the function within the organization in charge of overall responsibility for implementing strategies and policies related to the management of individuals (i.e. human resources). The "HR" initials are often used as a shortcut to the notion. The word, human resources is a relatively modern concept in management, coined in the 1960s. The origins of the function appear in organizations that have placed practice in welfare management, and also in those that implement the principles of "scientific management". From these notions, a largely administrative management activity has been created, which coordinates a field of employee-related processes and is currently becoming known as "staff". Initially in the United States, as well as in multinational and international corporations, human resources are rapidly becoming the most common name for this area, affecting the implementation of a more quantitative and strategic approach in managing the workforce, the need for corporate governance in order to obtain a competitive advantage, using rarely skillful and highly skilled workers. Simply put, the organizational strategy for managing human resources should increase the return on investment in the human capital of the organization and reduce financial risk. Human Resource Managers see this as achieving the merging of skilled and skilled people and the skills of the current workforce with current and future business plans of the organization and the need to increase return on investment and ensure future success and survival. To ensure that such objectives are achieved, the objective of the human resources task is to effectively implement the human resources requirements of the organization, taking into account federal, state, and local laws and rules of work, ethical business practices and net cost, in a way that maximizes, as much as possible, the motivation, dedication and productivity of the employees.

II. Management of Human Resources

Human Resource Management includes all the activities that managers undertake to attract and retain employees and ensure that they perform high-level work and contribute to the achievement of organizational goals. These activities shape the organization's human resources system, which consists of five main components: • recruitment and selection, • training and development, • upgrading of work and feedback, • salary and benefits, • relationships between employees.

Strategic human resource management is the process by which managers design the components of the human resources management system that are mutually consistent, with other elements of organizational architecture, and with the organization's strategy and goals. The objective of strategic human resources management is to build a human resource management system that promotes the efficiency, quality and innovation of the organization and the needs of consumers - the four carrier blocks of competitive advantage.

III. COMPONENTS OF HUMAN RESOURCES RECORDS

Managers apply recruitment and selection to attract and hire new people who have the ability, skills and experience to help the organization achieve its goals. For example, Microsoft aims to remain the world's leading computer software company. When Microsoft employs new software designers, hundreds of highly qualified candidates with excellent recommendations are being interviewed and rigorously tested, but only the best are employed1.

After recruiting and selecting employees, managers apply the second component, training and development, for members of the organization to develop skills and abilities that will enable them to carry out their work effectively now and in the future. Training and development are a permanent process; changes in technology and the environment, as well as the goals and strategies of the organization, often require members of the organization to learn new techniques and ways of working. In Microsoft, newly-appointed program designers receive workplace training in small teams with experienced mentors or advisers. Newly-trained students learn from the members of the team according to the needs of consumer programming to develop a computer system. The third component, rewarding work and feedback, has two objectives in human resource management.

First, rewarding the work can give managers information to make good decisions on human resources - decisions on how to train, motivate, and reward members of the organization. Thus, the component for rewarding work and feedback is a kind of control system that can be used for management purposes2.

Secondly, the feedback from the work done by rewarding the job serves to improve the members of the organization. When managers regularly evaluate the work of their subordinates, they can provide valuable information to subordinates about their good and bad old and areas in which they need to concentrate.

IV. INFORMATION TECHNOLOGY FOR EVIDENCE

Information technology is one of the most tools used by managers to manage the changes. Computer Hardware is the physical equipment used for activities related to the input, processing and transfer of data into the information system. It consists of the following: computers of different size and form, different input devices, data transfer and storage, and telecommunication devices that connect computers together. Computer software consists of detailed, programmed instructions that control and coordinate the components of computer hardware in the information system. Data management technology consists of a computer that manages the organization of data on physical storage media. Network and telecommunications technology, which consists of both physical devices and hardware, connects various parts of hardware and transfers data from one physical location to another. The network connects two or more computing devices to share data or resources such as the printer. The Internet is a global network of networks that uses universal standards to connect millions of different networks with more than 1.4 billion users in more than 230 countries around the world. The Internet has created a new universal technology platform that builds on new products, services, strategies and business models.

A. HRIS and e-HRM

Human Resource Information Software (HRIS) is a software or on-line solution used for data entry, data tracking and information requirements for human resource management in the organization, payroll calculation, and bookkeeping. HRIS is usually offered as a database in the human resources sector.

HRIS is focused on increasing the capacity of human resource management by: • Absorb new and promising technologies, • Simplification of work, • Optimizes the precision, stability and reliability of labor force data, • Simplify the deployment and retrieval of data, • Administration of all employee data, • Reporting and evaluation of employee data, • Company-related information, including manuals, disaster recovery methods and safety recommendations, • Comprehensive payroll integration, in addition to other accounting systems and financial software, • Monitoring applicants and administering their biographies

An efficient HRIS helps the organization to follow: • Paid free time - Paid time off (PTO) and attendance, • History of pay scales, • Position and degree of payment, • Strategies for developing overall efficiency, • Training was conducted, • Disciplinary measures, • Personal data of employees, • Identification of potential employees, • Administration for job seekers, including the interview process and selection

An organization can choose and adapt HRIS so that it meets the requirements. An efficient HRIS provides the organization with information without looking for anything, monitoring and examining the data for the applicant. The customized HRIS helps the human resources department to perform administrative tasks, allowing them to focus on other strategic functions. In addition, the necessary information is provided for the development of knowledge and skills, equal treatment in human resource management and career advancement. Managers can also gain access to the information needed to effectively and legally contribute to the success of their direct reports. Electronic human resource management (e-HRM), as a new phenomenon, is defined in many aspects. There are more generally accepted views, views and definitions. Information technology alters the way in which human resources departments handle record keeping and information sharing. It significantly reduces documentation and provides easy access to bulk data. It is also possible to track the achievements of the employee without going through controversial procedures. Intranet or other channels of web technology are used and can be used to implement various human resource strategies. Authorizations for different human resource functions can be distributed through HRM. There is a fundamental difference between the human resources and e-HRM information systems. HRIS has an application in the human resources department, where users of this technology are largely human resources professionals who use the human resources improvement system to improve the service for the business. E-HRM, on the other hand, is aimed at employees and management. The authors identify the main difference between HRIS and e-HRM. HRIS refers to the automation of human resources services, and e-HRM provides technology support for information about human resources services. "Technically speaking, it can be said that e-HRM is the technical unlocking of HRIS for all employees in an organization." Therefore, e-HRM is defined as a process of integration between human resources management and information technology, using web-based technologies in human resource management.

V. THE MOST SPECIFIC SOFTWARE SOLUTIONS FOR RECORDING OF HUMAN RESOURCES

Business success is not only a factor in strategy, product, and technology but rather depends on how the company manages its workforce. This is why it is crucial for employers to effectively manage and manage the human resources department, to keep employees motivated. For companies to achieve maximum output, they need to use modern software technology to effectively manage the quality of human resources. Many software for human resources, and open source software and premium versions have been developed.

Below is a list of different open source and open source software for human resources: • Sentrifugo. This great software starts from the point that the adjustments should be pre-defined, which gives them all completely free. This human resource management system is easy to install and can easily be adapted to fit into any organizational structure. It is one solution for aligning human resources activities. Sentrifugo features include performance appraisal, employee self-service, good analytics, background checks, service requests, resource requisition, interview scheduling, perfect dashboard, time management module.

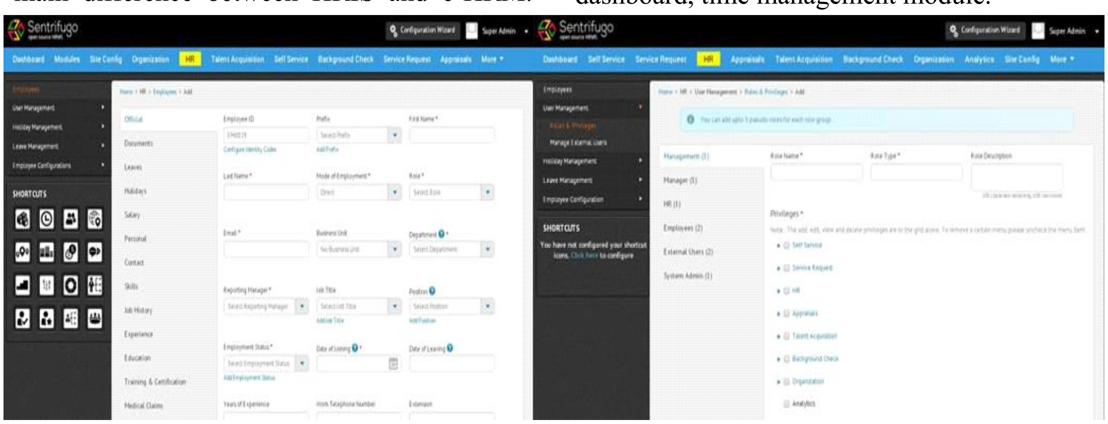

Figure 3: Data menu for the tasks and privileges of employees on the system's work screen - Sentrifugo

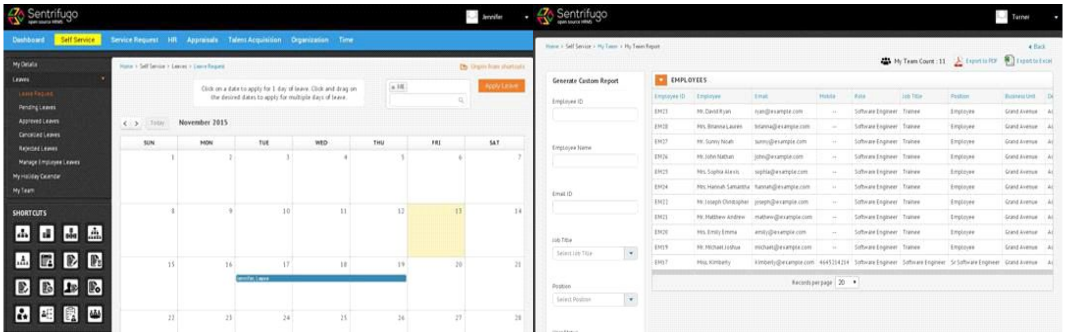

Figure 9: Menu for creating reports for employees by managers on the system's work screen - Sentrifugo

WebHR software runs as an "employment-to-retirement" strategy, which simplifies day-to-day organizational tasks, not just in the most important capital, human resources, but in the whole organization. Basically it bridges the gap between human resource management and information technology. WebHR includes a rich social HR function, a complete solution for hiring, self-service employees, extremely user-friendly, payroll, low cost biometrics, comprehensive reports and graphs, an on-line internship portal and a good broadband profile of employees. WebHR acts as a bridge between the records of human resources and information technology. It enables businesses to automate many aspects of human resource management, with the dual benefit of reducing the workload of the human resources department, and increasing the efficiency of the department by standardizing human resources processes.

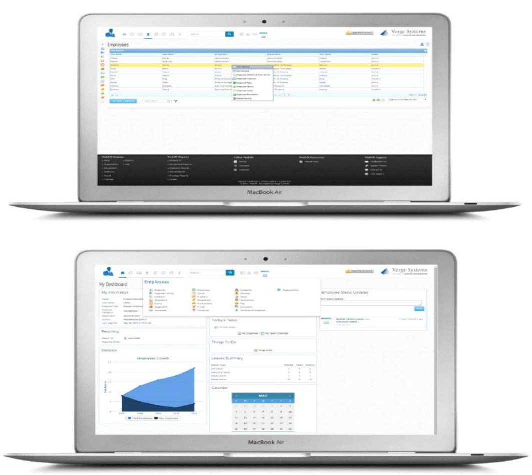

Figure 17: WebHR work window

Bitrix24 offers 35 plus free means of work in one place and is a perfect communication and collaborative platform. Freemium software is free for a limited number, up to a maximum of 12 users. Bitrix24 contains large modules such as Social Intranet, interactive flow of activities, a system that provides chat, badges, company announcements, photo gallery, work processes (holiday requests, business trip expenses and general requirements). In Bitrix24, people are in the spotlight. In the employee directory, you can easily get to the contact information or through a list filter to find the right person for a particular search. By clicking on an employee in the list, it comes to the profile page of that employee. All employee information is visible to the public and has options for instant messaging or comment on the person's blog or photo gallery.

OrangeHRM. The system provides a human resource management platform that provides access to a wide community of users. The modules include system administration, information management for employees, time management and attendance, employment, performance, self-service for employees, etc. OrangeHRM software is open source and is a free human resources management system that offers a wealth of modules that suit the needs of every business. This frequently used system is rich in features, intuitive and provides an important platform for human resource management, along with free documentation and access to a wide community of users.

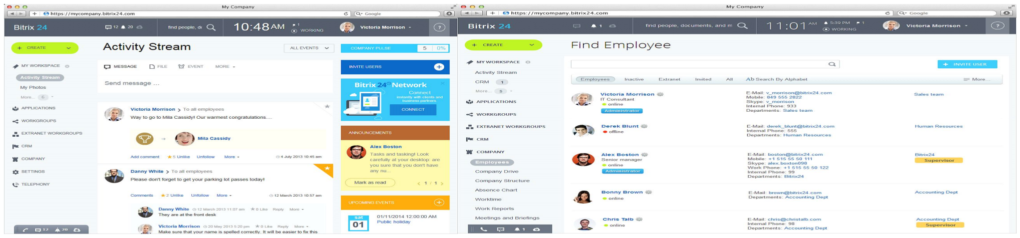

Figure 19: Directory for employee search and Course of activities

Figure 21: Employee Data Management Module and Global Absentee Management System

VI. Conclusion

Rapid development of new technologies is felt around us and constant innovations and changes are increasingly being applied in all areas on a daily basis. So our records did not remain untouched by this technological and Internet "fever". Software companies create and offer software solutions to facilitate certain record functions and activities. Changes in information technology are faster than any other processes in organizations. IT opportunities for human resource management are endless. Regarding the coverage of human resource management functions, the majority of them can be supported by IT, but not all that has been confirmed in our research. Of course, this is in the context of expectations and in terms of support the results and some similar research. It should also be noted that when introducing technological solutions, problems and errors in the database, errors of the server, etc. are possible, which the respondents in our research are aware of (especially emphasized by the older group). But, as a result, in our research, in general, researchers from the younger group with greater awareness of the everyday technological changes, accept them more boldly and are ready for risk, and sufficiently efficient in the direction of modernization, facilitation, and improvement of work. With the advent of new generations of leading positions in the records sector, IT use will increasingly be accepted, because every day, it is a fact that the numerous benefits of using specific tools, which include saving time, resources, and reducing administrative burdens on employees. Finally, based on all of the foregoing, we can fully conclude that our general assumption was: "The use of e-HRM systems and other HRIS tools in organizations in the Republic of Macedonia. Macedonia is already a developed practice that finds support from the employees.

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Distributing Knowledge Through E-learning Platforms

M. Bakator, D. Radosav
University of Novi Sad, Technical Faculty "Mihajlo Pupin" Zrenjanin, Republic of Serbia
mihalj.bakator@uns.ac.rs, radosav@tfzr.uns.ac.rs

Abstract – In this paper the applications of e-learning is analyzed. In addition, e-learning platforms are addressed as an important part in the modern world of knowledge distribution. The main goal of this paper is to provide a concise but informative overview of e-learning as a fundamental part of education in schools, universities, small and medium-sized enterprises (SMEs) and of individuals. Certainly, the importance of e-learning is evident in various fields of manufacturing industries. On-demand learning content, and online classrooms make it possible for almost any individual to acquire sufficient knowledge and skill on almost any topic. This paper recognizes the significance of e-learning platforms for distributing information and analyzes it thoroughly. Further, this paper provides an adequate basis for future research in this domain.

I. INTRODUCTION

E-learning as a part of computer-assisted learning can be defined as a guideline, instruction or recommendation with the goal to promote knowledge distribution and learning. E-learning includes the use of devices which are have computer chip. Such devices are desktop and laptop computers, tablet devices, smartphones and others [1]. Why is e-learning important? The application of e-learning in education is becoming a necessity. The hyper-distribution of vast amounts of information affects the students' learning process. Thus, e-learning provides a structured and controlled distribution of knowledge and it makes it available anywhere and anytime. As an alternative but also as a support to the traditional classroom education system, e-learning promotes knowledge and idea sharing between students and peers. Another important aspect of e-learning is the interactivity and the opportunity for collaboration and idea sharing [2]. Besides the application of e-learning in education facilities, it can be used in other industries as well. For example, employees in a manufacturing enterprise can attain valuable skills, knowledge and information through e-learning. Certainly, for adequate production processes, enhancing the skills of employees is vital [4]. A more wider and effective approach to e-learning are e-learning platforms. E-learning platforms have developed a lot over the years. Teacher assists, effective course management, and other modern education tools are available through these e-learning platforms [4]. Surely, if globalization and dynamic changes on the market and economy are taken into consideration, e-platforms are a necessity in order to fulfill the need for effective and portable education. Now, in order to determine if e-learning has a future, it is necessary to address the variety of use-cases where e-learning and e-learning platforms are implemented. Besides formal educational institutions, enterprises can also apply e-learning tools to increase their intellectual capital which further affects productivity and overall business performance. Therefore, analyzing the impact of e-learning on learning itself becomes a necessity. A thorough analysis of literature in this domain is conducted in order to provide significant insight regarding the improvement of learning through e-learning and the distribution of knowledge through e-learning platforms. In order to provide a more structured form, the following research questions are proposed:

1. How diverse is the application of e-learning?
2. Are e-platforms the future of education and knowledge distribution?

In this paper the applications of e-learning are analyzed. In addition, the use of e-platforms for knowledge distribution is addressed. The goal is to present a concise overview of how important and how far did e-learning applications come not just in the domain of formal education but also in various industries. The paper analyzes previous studies and discusses the potential of e-learning and e-learning platforms.

II. E-LEARNING APPLICATIONS

E-learning systems are enhancing and strengthening educational strategies. Observed from an economic and educational standpoint, e-learning has a tremendous impact on social-economic processes. This means that e-learning is a crucial part of any organization, individual or society as a whole. E-learning has found success in many types of courses. The success part can be viewed from different perspectives, such as attendance, technological and financial aspect [5]. Further, there are two main types of e-learning: synchronous and asynchronous. Synchronous e-learning is an approach where the learning material is presented at the moment via virtual classrooms. Basically, this type of e-learning is very similar to traditional classrooms, with the difference that the lecture is being broadcasted online. However, online, virtual classrooms have a clear advantage over traditional classrooms. First, students don't waste time and energy getting to the educational facility. Second, during the online lecture, students can write down questions which are also seen by the lecturer. This way, constructive and critical thinking is introduced without interrupting the lecturer. Some varieties of synchronous e-learning are virtual classrooms, video conferencing, webinars, and distance coaching [6].

Further, the other type of e-learning, which is more often used, is asynchronous e-learning. Contrary to the synchronous type, asynchronous e-learning is based on the on-demand approach. This includes videos, podcasts, e-mail, factsheets, membership sites, document management systems, simulations, Internet, forums, mobile applications, performance support [4]. It is evident that asynchronous e-learning is more flexible compared to the synchronous approach. Surely, organizing online classrooms in real-time requires more time and resources to set up compared to uploading and sharing the learning material online. Now, in previous studies it was noted that students are positively affected by e-learning and were additionally motivated to study when the study material was in digital form [7]. Next, besides formal education, e-learning is also applied in organizations as well. Employees and managers can actively increase their knowledge on important subjects which are related to the business activities. However, enterprises, especially small and medium-sized enterprises (SMEs) are reluctant to accept e-learning as a valid method to increase their intellectual capital. The main reasons is the lack of financial resources to implement such e-learning platforms and the perception that e-learning is nothing more than a database of digital books. Now, this is not the case as e-learning is characteristic of interactive learning methods [8]. SMEs could increase their intellectual capital through e-learning which would further positively affect productivity and innovation intensity. E-learning indeed can have a positive effect on business performance of SMEs. The success of e-learning application in SMEs depends on the enterprise size, industry, number of employees and organizational culture. Therefore it is important to analyze every aspect of e-learning application in a SMEs. To concisely present the application of e-learning a framework is shown on Figure 1.

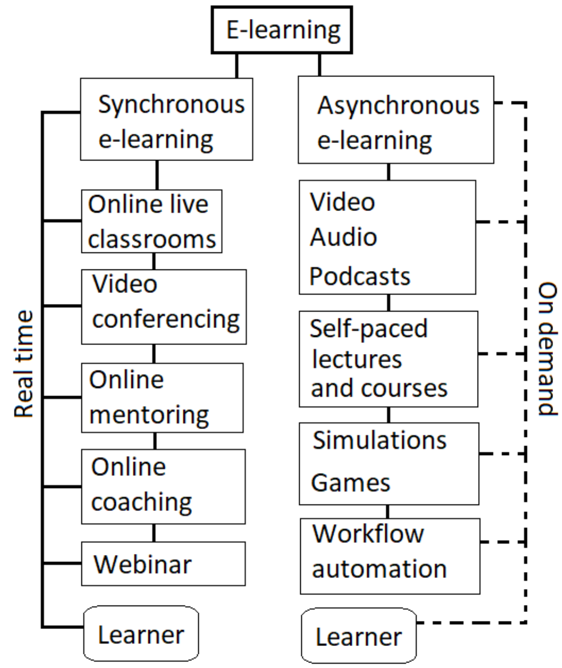

Figure 1. E-learning types and application

On Figure 1 the two types of e-learning are depicted. In addition, the applications within these types are given in a generic way. For synchronous e-learning, the distribution of information is in real time. This type of e-learning is adequate for language courses, social skill development or brainstorming sessions.

As for the asynchronous applications, they are more widely used in on-demand courses in the domain of management, financing, banking, and other slower-paced learning. Also, interactivity in these lectures can have more depth as there is no limited time frame for the lecturer. A clear advantage of this type of e-learning is the access to lectures and other learning material.

Overall, both e-learning types can find application in various fields and industries. Manufacturing enterprises can enhance workplace safety, work ethics and employee skills through applying the e-learning approach. Schools and universities can apply e-learning platforms in order to enhance learning material distribution. Certainly, e-learning and an adequate platform can positively affect the overall distribution of knowledge, regardless of specific field of application. Further, e-learning has advanced in an incredible pace thanks to the Internet. Articles, journals, websites, forums, simulations, games, audio recordings, podcasts, videos, images and many others present a remarkable source of knowledge. Additionally, search engines makes this knowledge more accessible. It is evident that e-learning covers and includes the academic field, the consumer field and the corporate filed as well [9].

The crucial part of e-learning is the interactivity aspect. Interactivity provide a higher quality learning and training of learners [10]. In order to make e-learning more structured, e-learning platforms are developed and applied in small and large scale educational courses and lectures. A more in-depth overview of e-learning platforms is presented in the next section.

III. E-LEARNING PLATFORMS AND KNOWLEDGE DISTRIBUTION

A more structured application of e-learning is conducted through e-learning platforms. There is a large number of e-learning platforms which offer various courses for free, or it is subscription-based or one-time payment-based. One of the important parts of e-learning platforms is the possibility for feedback from students. High-quality feedback from students can significantly improve future performance of the whole e-learning platform [11]. Further, a learning management system (LMS) is used with e-learning platforms in order to assists lecturers and students. The LMS includes several important elements, such as content sharing unit, interface, reporting unit, and database of educational resources [12].

The content sharing unit of the e-platform includes protocols through which the educational material is distributed. Further, the user interface is a solution for easy access and control on the educational platform. The user interface is available for the learners, tutors, coordinator and administrator. Most of the time access to the e-learning platform is regulated with password-protected accounts. As mentioned before, depending on the type of the platform creating an account can be free or requires some kind of payment. Further, the reporting unit presents the feedback-loop through which information from the students/learners is sent back to the tutors/teachers with the goal to enhance future learning experience. Finally, the database of educational resources includes all the learning material which is distributed through the platform to the students. This explained e-learning platform is graphically presented on Figure 2.

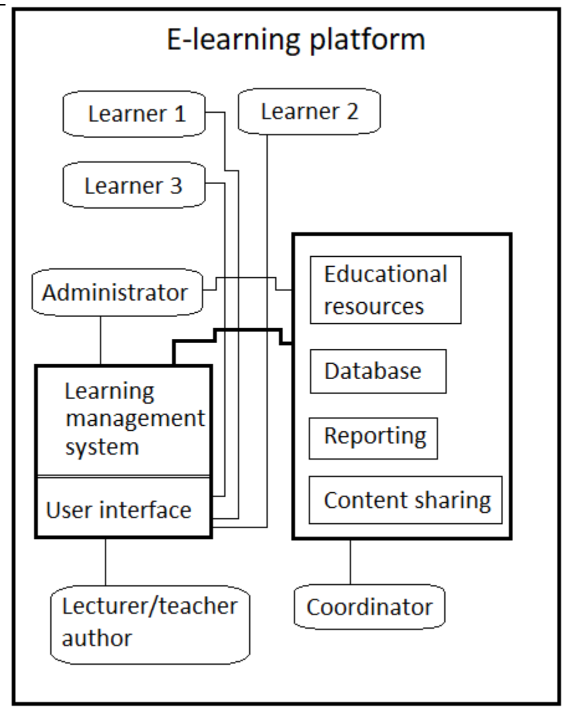

Figure 2. E-learning platform

As previously mentioned, and presented on Figure 2, a simple e-learning platforms can include a central LMS alongside with a user interface. Additionally, there is the database, educational resource (external), content sharing and reporting elements of the platform. These are crucial parts, as all the content is within them.

Furthermore, an important aspect of e-learning platforms is their role in knowledge management in SMEs. Knowledge management has a big impact on the business performance of an enterprise (micro impact), and on the economy (macro impact) [13]. E-learning tools can positively affect managers' performance in decision making and long-term planning [14]. Studies shown that in Serbia, SMEs are open to information-communication technology (ICT) use in business [15]. In the same study it was concluded that ICT applications overall positively affected organizational performance and had a significantly less impact on individual relationships between employees. However, it was also noted that ICT positively affected employee satisfaction with organizational learning.

Based on the previously analyzed studies, it is evident that e-learning and e-learning platforms are the backbone of knowledge distribution in educational facilities, businesses, and among individuals. It can be safely assumed that the Internet is a key part of knowledge distribution.

On Figure 3, a macro model of e-learning platforms and knowledge distribution is presented.

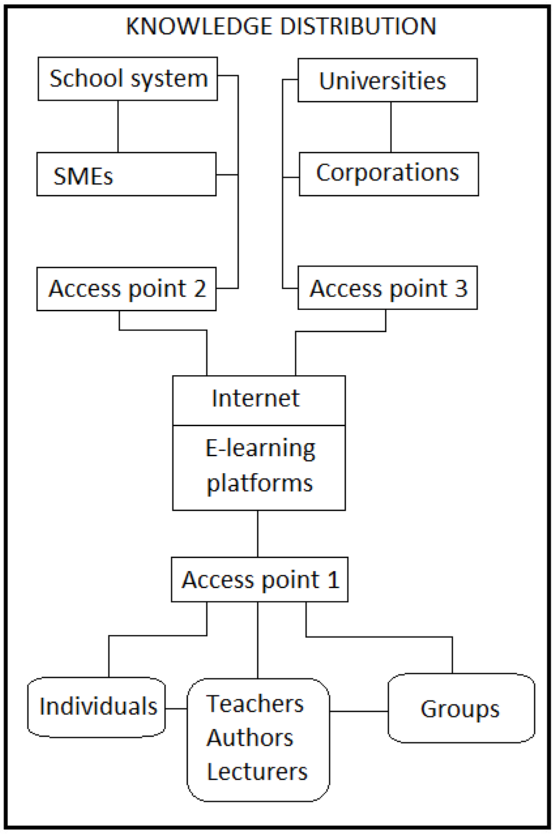

Figure 3. Knowledge distribution and e-learning platform

On Figure 3, it is proposed that the majority of e-learning platforms rely on the Internet as a network infrastructure and various access points. Individuals, groups (teachers, authors, students, lecturers), SMEs, corporations, schools, universities, access the e-learning platforms through these access points. Access points can be free or behind a one-payment or subscription wall. Whatever the case, e-learning platforms and the Internet as a distribution channel provide an immense amount of information and data.

Overall, it can be seen that e-learning platforms are an important element of knowledge distribution. The educational system is indeed enhanced with such platforms.

IV. Conclusion

Before conclusions are made the research questions are addressed:

1. How diverse is the application of e-learning?

The applications of e-learning include employee training in SMEs, corporations, health institutions; online classrooms in universities; on-demand courses; online certified courses; interactive courses for people and children with disabilities and many more.

2. Are e-platforms the future of education and knowledge distribution?

With the current development in modern educational environments, e-platforms represent the future for knowledge distribution. Through these platforms, knowledge in the form of data, instructions, tutorials, courses and other are effectively distributed to users. In this whole distribution process, the Internet plays an important role.

It can be concluded that e-learning platforms can enhance the learning experience of students and it can help increase employee skills in SMEs. In this paper, several generic models are presented in order to provide a concise overview of e-learning platforms and knowledge distribution. For future research it is recommended to address various specific e-learning platforms and evaluate their application in various SMEs and other educational institutions. In sum this paper provides a solid basis for future research in this domain.

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Information Retrieval Services for Electronic Collections of Texts Produced by Language Learners

R. Jakimov*, C. Martinovska Bande*, M. Kusevska**, B. Ivanovska**
* University Goce Delcev/Computer Science Faculty, Shtip, Republic of North Macedonia
** University Goce Delcev/Faculty of Philology, Shtip, Republic of North Macedonia
robert.101816@student.ugd.edu.mk, cveta.martinovska@ugd.edu.mk, marija.kusevska@ugd.edu.mk, biljana.ivanovska@ugd.edu.mk

Abstract - This paper describes an information retrieval application developed for research activities based on text collections produced by language learners and a learning environment for language teaching and translation. The aim is to introduce new technologies and new modalities of learning in higher education and to create a collection of data necessary to teachers and doctoral students for evidence-based research. The application enables grouping the texts according to specific search criteria and is developed using the combination of HTML5, CSS and JavaScript in the front-end and PHP in the back-end.

I. INTRODUCTION

Learner corpora are electronic collections of texts produced by language learners. Interest for them is growing fast in the Second Language Acquisition and Foreign Language Teaching communities because they provide an innovative and unique methodology for empirical research with theoretical and practical implications that can be used by researchers, university language students, teachers and other educators [1-7].

The Macedonian system of higher education is often criticized for its traditional methods of teaching, slow implementation of any changes and unmotivated students. This creates disparities between the current educational environment and the expectations for universities set in UNESCO 2018-2021 39 C/5 Draft Resolution to "prepare and equip graduates to contribute to sustainable development and global citizenship … and to develop innovative curricula, study programmes and alternative learning pathways in order to address the gap between traditional learning and learners and enable access routes to higher learning" (p. 46).

In order to address this weakness, the Faculty of Philology at Goce Delchev University in Shtip, Republic of Macedonia, in collaboration with the Faculty of Computer Science at the same University, has set to create a Macedonian Corpus of Learner English and German (MACOR).

Recognizing the needs of the Macedonian educational system and the higher educational curricular, we have set the following general aims for this project:

- to develop a sound base for research activities in the field of Second Language Acquisition, curriculum design, language teaching and translation;
- to motivate researchers, teachers and students (undergraduate, graduate, doctoral) to develop skills, knowledge, and attitudes for evidence-based research in order to make informed decisions in their work;
- to provide basis for designing improved, innovative curricula for language students of English and German, future teachers and translators, which will create a learning environment that will enable young people to develop new skills and values;
- to make use of the new technologies and new modalities of learning in higher education in order to provide for quality education.

II. DESCRIPTION OF THE LEARNER CORPORA

MACOR consists of three sections: 1) learner English subcorpus; 2) learner German subcorpus; and 3) native Macedonian subcorpus. All three sections contain materials produced in response to similar tasks and in similar conditions. The native Macedonian subcorpus provides conditions for studying the influence of the mother tongue in the process of learning a foreign language.

The corpus covers levels A1-C2, and enables research according to a number of variables: age, gender, mother tongue, education, region, proficiency level, years of learning English/German, L2 exposure (Stay in a country where English/German is spoken? If yes, when?

How long?); if the person speaks other foreign languages and how well. Some of the variables used in the application are shown in Table 1.

TABLE I. SEARCH VARIABLES

variable	comparison
Age	Comparison of learners based on the age
Gender	Comparison of learners based on the gender
Nationality	Comparison of learners based on the nationality
Nativeness	Comparison of non-native to native speakers
Number of languages spoken	Comparison of learners based on the number of languages they speak
Number of years learning English	Comparison of learners based on the number of years they learn the English language
Number of yars in English speaking countries	Comparison of learners based on the number of years they spent in English speaking countries
Level of study	Comparison of pre-university and university learners
Programme of study	Comparison of learners from secondary school, bachelors, masters
Type of text	Comparison of texts based on the type (narrative and discussion)
Place of weiting	Comparison of texts based on the place of writing (in classroom and at home)
Use of grammar books	Comparison of texts created using grammar books to those created without
Use of monolingual/bilingual dictionary	Comparison of texts created using monolingual/bilingual dictionary to those created without
Text length	Comparison of texts based on the number of words

MACOR aims to collect at least 500.000 words of functional language by Macedonian learners of English and German, i.e. letters and emails, including asking for information, asking for help, invitation, refusal, apology, thank-you letters; narratives of events, holidays, experiences; descriptions of places buildings, people, landscape; argumentative essays; and Discourse Completion Test (DCT); role plays.

III. INFORMATION RETRIEVAL APPLICATION

The web application (Fig. 1) covers search and information retrieval of three previously mentioned sub-corpuses. Users are able to search the corpuses or subsets of data based on a number of variables as well as to download the available files in different formats (txt, xml, pdf).

Files are named using the basic characteristics of the text and the author (student identifier number, level of study, nativeness, place of text production, etc.).

Using variables enables searching different sub-corpuses of data, comparing the results of learners groups and downloading specific parts of the corpuses. For example, it is beneficial to compare the non-native speakers to native speakers, or learners at the pre-university level to those at the university level.

The user interface is created using HTML5,

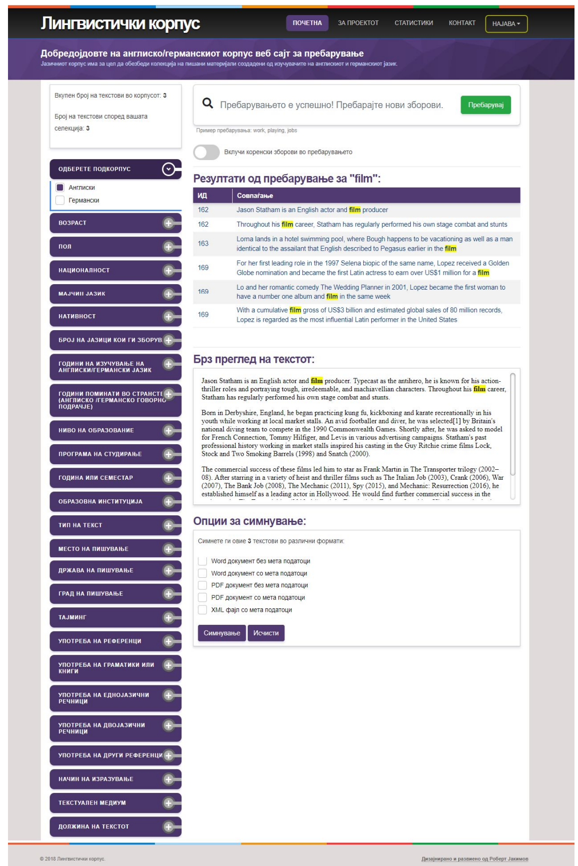

Figure 1. *Information retrieval application for electronic collections of texts*

CSS3 and JavaScript, and the application uses both CSS and JS Bootstrap libraries. The application has a mobile responsive design and is suitable for use on all desktop and mobile devices. All forms designed for filling or selecting options are verified on a client-side with JavaScript, in order to avoid sending incomplete requests to the server and losing previously entered data by the user. Figure 2 shows the Entity Relationship used to create the tables in the application.

The back-end part of the web application is responsible for storing and organizing data. Back-end part communicates with the front-end, sending and receiving information that needs to be displayed as a web page. We used the latest version of PHP [8] scripting language to create the back-end part of the application.

Search operations on the linguistic corpuses are realized using MySQL FULLTEXT indexing and retrieval technique [9] implemented on MyISAM tables. Indexes in databases are usually used to improve search performance and serve as a substitute for a LIKE clause.

There are three types of Full-Text Indexing and Search [10] [11]: Natural Language Full-Text searches, Boolean Full-Text searches and Query expansion queries. We used the Boolean Full-Text searches in the application.

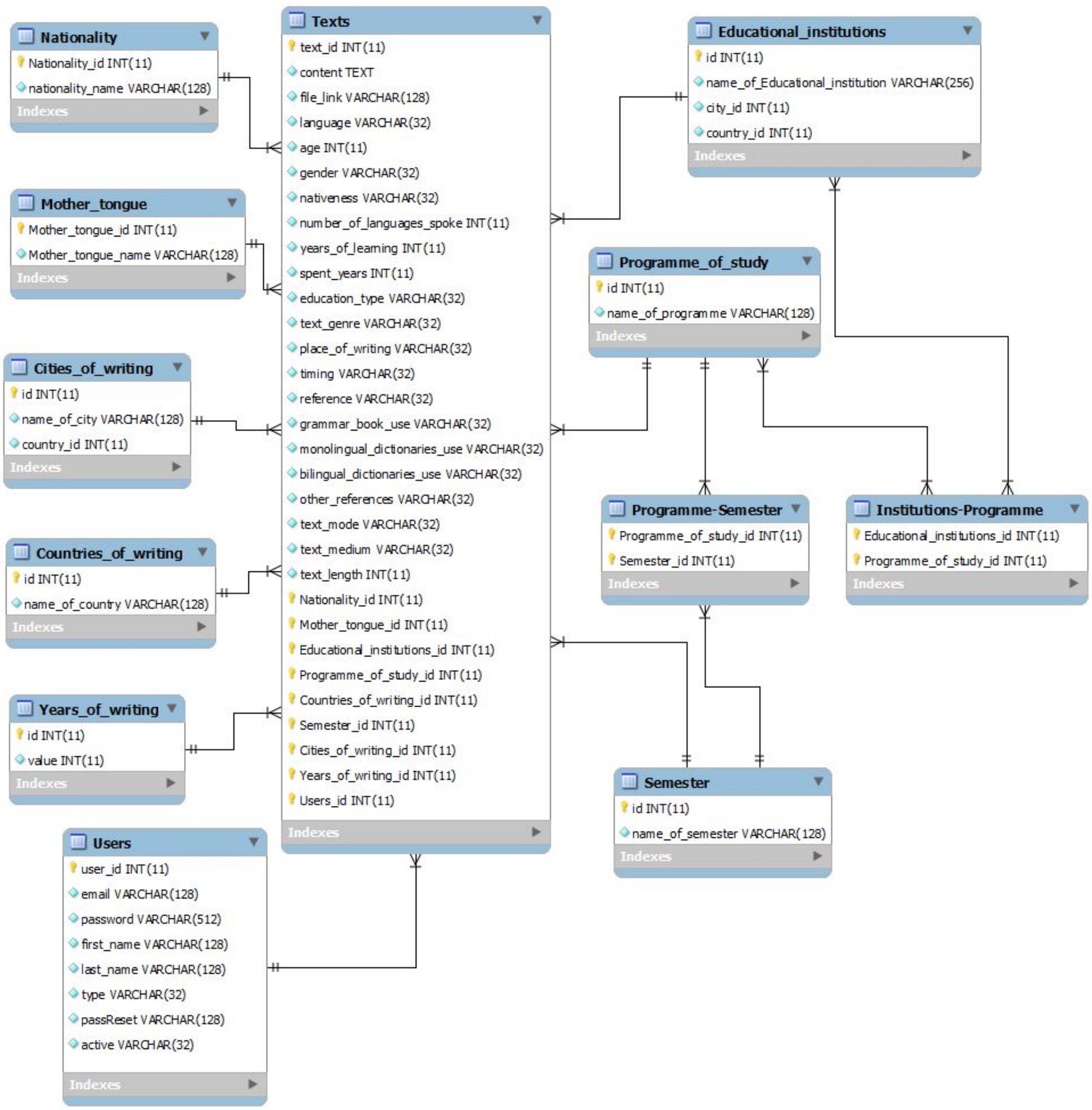

Figure 2. *Entity Relationship diagram implemented in the application*

Full-text search technique should be enabled when creating the table, indicating which columns will be indexed:

CREATE TABLE Texts (

text_id INT UNSIGNED AUTO_INCREMENT

NOT NULL PRIMARY KEY,

content TEXT, FULLTEXT(content));

Natural Language Full-Text Search [12] interprets the search string as free text and does not require special operators. The searches are done using the IN NATURAL LANGUAGE MODE modifier. The MATCH() function searches the required string in the text set composed of one or more columns included in FULLTEXT indexing. For each row in the table, the MATCH() clause returns a relevant value, i.e. a measure of similarity between the search query and the search results.

The basic search format is the following:

SELECT * FROM table_name

WHERE MATCH (col1, col2)

AGAINST ('search terms'

IN NATURAL LANGUAGE MODE);

When MATCH() is used in the WHERE clause, as in the example above, the ranks returned as a result are sorted by the relevance of the occurrence of the word to a particular row. If the relevance is 0, this means that the search word does not exist in the queue. Thus the relevance is based on the ratio of the number of appearances of the searched string in the current row and the total number of occurrences in all rows that are searched.

The Boolean Full-Text Search [12] interprets the search string, using the rules of a particular query language. The searched string contains the search terms, but it can also contain operators that specify the requirements and make them uncharacteristic. For example, whether a particular word must be present or must be absent in the appropriate rows and the like.

The basic search format is the following:

SELECT * FROM table_name

WHERE MATCH (col1, col2)

AGAINST ('search terms'

IN BOOLEAN MODE);

IV. SEARCHING DOCUMENTS WITH APACHE LUCENE

For future work with the linguistic corpuses we installed Apache Lucene. We plan to incorporate some information retrieval techniques from Lucene in our application. Apache Lucene is an open-source library that allows searching through files, mostly text documents [13]. Lucene contains libraries that can be used with various programming languages, such as PHP, Delphi, Perl, C#, C++, Python, etc.

The Lucene indexing process consists of converting files into document objects with title, category, description, date, author, extension, and web links [14]. These attributes are just an example of information that can be stored for further search, but in practice a larger number of attributes are used. Unlike the Hash maps, in Apache Lucene as an index list, a vector structure is used where words and documents can be stored and split into simple sequential structures. Once a document-object is created, the indexer writes the document to the index file. Then, an analyzer is created which determines the physical location of the index, whether a new index will be created, or one of the existing ones will be used, which scoring model will be used and the like.

Once a user makes a search, the application is parsed and converted to a plain text list. Then the analyzer processes it, removing punctuation marks, accents, excess words, and so on. The analyzer, using Stemmer, receives the roots of the words in the search which are used for further search. At the same time, a new object is created in which the directory in which the index is stored is loaded.At the end IndexReader and IndexSearcher objects are created. The Index Searcher use the search method which arguments are a Query object and an empty collection of documents and searches across the index to fill the collection of documents that meet the search criteria. The order in which the documents are filled depends on the scoring, which in turn depends on the so-called scoring model that is selected and set when indexing and searching documents. From the collection of documents, a series of documents called hits are obtained.

Document scoring is one of the most important methods of Lucene [15]. Apache Lucene offers quick sorting of search results, while hiding the complexity of the entire process using ready-made classes and methods.

Integrating Lucene with an existing project is quite simple if using front-end based Java Servlet or JSP. However, if the application is built in PHP or Python, there are two main options for integration of Lucene:

1. Using PHP (also applies to Python / Ruby) port for Lucene

2. Using the Java Lucene back-end that is connected to the front-end using HTTP or SOAP, that is, using the Apache SOLR in the back-end and connecting to the PHP code with the help of calls to Web services.

Apache SOLR (Option 2) is an excellent solution for deploying PHP with Java Lucene over HTTP and is easy to implement. If more Lucene customizations are planned, like custom query queries, then it is recommended that you use your own servlet architecture. As we explained above when talking about Lucene, it consists of two main functionalities: indexing indexes that will be done in PHP with UpdateServlet and a search that is implemented with SearchServlet.

SearchServlet takes care of searching the files while UpdateServlet is responsible for updating or creating the index. Corresponding servlets will be called by the PHP code using CURL at the moment when the end user is making a text or search query.

Note that Apache SOLR requires updates to be provided with full XML without empty values, but if we own a database (example MySQL, SQL and so on) where we store data, then we need to implement our own servlets.

V. CONCLUSION

The most specific objective of the application is compilation of an electronic learner corpus of English and German interlanguage of Macedonian learners which will be used for research by junior and senior language researchers, by undergraduate and graduate language students, and by novice and experienced language teachers.

The language corpus is open for use to all researchers, language teachers, university students (undergraduate, graduate and doctoral), curriculum and material designers as well as other educators. Researchers can use it for their theoretical studies; language teachers can use it to diagnose their students' language needs; university students can use it for performing different types of tasks in relation to their studies and interests, and for writing their seminar papers as well as master's and doctoral thesis. It will also be of enormous importance for pre-service and in-service training of teachers of English and German.

The use of the corpus will contribute to:

- establishment of links between empirical research and second language acquisition, curriculum design, language teaching, and methodology development;
- pre-service and in-service training of language teachers and educators for using language corpora in their work for syllabus and material design, test design, etc.
- development of a methodology for language corpus design and use which could then be extended to other languages as well as to other types of language corpora.

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Framework for Teacher Education and Development

A. Ristić*, R. Ristić*, D. Cvetković**
* OŠ Kosta Trifković, Novi Sad, Republic of Serbia
**Faculty of Education, Sombor, Republic of Serbia
aleksandramarkovic@ymail.com, radisav@gmail.com, dcveles@gmail.com

Abstract - Teacher productivity in terms of students' positive learning outcomes is to a large extent, dependent on teacher competence. Extant literature on teacher education is replete with competing models and paradigms on competency-based teacher preparation and development. This paper discusses a conceptualized alternative core competency framework for teacher education and development. Best practices which influence teacher competence such as Continuous Professional Development (CPD), mentorship, learning communities and the issue of teacher identity are reviewed. Four core rubrics of teacher competence and their respective indicators are thoroughly discussed. On the basis of these four rubrics, the paper highlights a 3-paradigm process for deriving realistic, attainable, relevant and competency-based curriculum goals and content. The paper recommends among other things that, the training and retraining of teachers should be sustained in all educational institution so as to maintain the desired teacher competency.

I. INTRODUCTION

Contemporary theory of Economic growth places much emphasis on the role of human capital in the overall framework of socio-economic development. The relationship between education and Economic development has been given prominence in the development literature over the years. Education is considered as a crucial input into the development process (Gyimah-Brempong, 2010). It is partly in view of this crucial role education plays that it was considered as the second Millennium Development Goal (MGD) by the United Nations (UN). The school curriculum is the vehicle that transports the educational aims and goals of any given country. It communicates what we choose to remember about our past, what we believe about the present, and what we hope for the future (Pinar, 2004). In a nutshell, curriculum goals reflect the needs and aspirations of a given people.

There is a growing consensus among researchers and teacher educators that the single most important factor in the determination of student performance is the competence of the teacher. In the opinion of Oyebamiji (2002), teachers are the most refined human species who skillfully identify, develop and nurture the potentials of productive citizens for the creation of wealth, pleasure and services so as to sustain the quality of life. Properly trained teachers play an important role in the complete wellbeing of a nation. Well-qualified, competent and effective teachers are the only people that can make a difference to teaching, learning and the quality of a nation's workforce; hence the importance of teacher education (Adegoke, 2015). Consequently, if the national goal of providing relevant education to all categories of students is to be achieved, then it becomes necessary for government to train and retain high-quality teachers at all levels of the education sector. Moreover, the successful implementations of any curriculum, irrespective of the level, whether basic, secondary or tertiary level of education, will largely depend on the quality and competence of the teachers. Teacher quality is therefore crucial and has been globally accepted to be significantly associated with the quality of education in general and students' learning outcomes in particular (Pandey, 2011). The popularity and productivity of schools and colleges, particularly in Ghana, largely depend on the quality of its teachers. The mad rush of parents to such schools to seek placement for their wards is often influenced by the perceived quality of its teachers and instruction.

Globally, teachers' roles are changing under the influence of access to information and use of communication technologies, drives for accountability parallel to decentralization of education systems, and increasing diversity of student populations. Implications of these influences for a change in teacher preparation are internationally discussed with a view to establishing the competencies teachers need in order to meet the challenges related to the cultural, social, and value implications of teaching (Garm & Karlsen, 2004; Ostinelli 2009, van Tartwijk, Brok, Veldman & Wubbels, 2009).

II. PERSPECTIVES ON TEACHER COMPETENCE

Competence is one of the most contested concepts in the literature on teachers and teacher education, having provoked much debate since it first appeared in the late 1960's (Libman & Zuzovsky, 2006). Historically, competence models were developed from a behavioral and positivist perspective to identify core behaviours and skills needed in a wide range of occupations (Bogo, Mishna & Regehr, 2011). This concept was first conceived as a set of "discrete", "theory free", practical skills (Harris, 1997). By implication, a competent teacher could be identified based on observable events in the teachers' performance, and teacher preparation would therefore need to focus on novice teachers' learning competences such as classroom management and teaching methods (Huizen, Oers & Wubbels, 2005). Critics argue that behaviorists' competence-based notions of teaching and teacher education neglect other important aspects of teacher expertise, namely knowledge and understanding, values moral sensibilities, and professional identity (Pantic, Wubbels & Mainhard, 2011). Teacher competence can therefore be conceptualized as including knowledge and understanding, a sense of how to deal with values, moral issues, beliefs and identity, and behavioural skills. In general, competence refers to a set of knowledge, skills and attitudes or values that are evident in the behaviour of professionals as they perform in the domains associated with their profession (Epstein & Hundert, 2002). For Weinert (2001), competence should be considered as the cognitive capabilities and skills which individuals have or with which they can learn to solve certain problems, in addition to capabilities concerning motivation, volition and social willingness permitting one to successfully and responsibly apply solutions to problems in variable situations.

The various perspectives on competence appear to equally ignore the influence of reflective practice on teacher quality and effectiveness. This paper therefore conceptualizes teacher competence as the effective application of aspects of teachers' professional knowledge, values, skills and reflective practice to maximize students' learning outcomes in the classroom situation.

III. Continuous Professional Development

Continuous Professional Development (CPD) is a time tested strategy for sustaining the competencies of teachers. Gall and Renchler (1985) hit the nail on its head when they describe professional development as "efforts to improve teachers' capacity to function as effective professionals by having them learn new knowledge, attitudes and skills" (p.6). However, scholars have criticized this perspective on grounds that it appears to be compensating teachers for deficiencies in skills or knowledge and viewing them as empty vessels "to be filled" (Garmston, 1991, p. 64). Other scholars consider CPD as a "professional growth" paradigm that characterizes development as more self-directed arising from the learner's interests and needs (Feiman-Nemser, 2001). Other researchers perceive CPD as an "educational change" paradigm which is focused on bringing about change (Fullan, Hill & Crevola, 2006; Warren-Little, 2001). On their part, Joyce and Showers (2002), and McLaughlin and Zarrow (2001) consider CPD within a "problem solving" paradigm which links development to making improvements in order to address identified issues such as student achievement needs. In the opinion of Darling-Hammond (2003), CPD is not training, but a process of continued intellectual, experiential and attitudinal growth of teachers.

Whichever way we look at teachers' CPD, the bottom line is that, it aims at sustaining the professional competencies of teachers. It does not necessarily arise on account of the need to address deficiencies, but occasioned by the growing recognition of education as a dynamic and professional field (Guskey, 2000). In addition, since the school curriculum is not static and subject to reforms and innovations, there is always a corresponding need to continuously update the knowledge, skills and values of teachers to ensure effective implementation. As a matter of principle, professional development needs to be, first and foremost, attentive and responsive to student learning and performance. It needs to attend to authentic themes and issues in the day-to-day work of teachers in relation to student learning and be respectful of those theoretical and technical knowledge bases that inform the act of teaching (Broad & Evan, 2006).

IV. Mentorship

Undoubtedly, promoting the mentoring of npwly trained teachers could enhance teaching competence and quality. This therefore implies that, institutionalizing mentorship in our schools and colleges is another window of opportunity offered to educational authorities to whip up teacher competence. It has even been argued in certain circles that, the most effective way to transfer skills and knowledge quickly, and inculcate loyalty in new employees to cooperate in an organization is through mentoring (Robinson, 2001). Mentors help teachers to develop practical knowledge for teaching which includes acquiring techniques and skills, knowing about resources, and understanding the context and culture of teaching (Feiman-Nemser & Remillan, 1996).

In the opinion of Furlong, Barton, Miles, Whiting and Whitty (2000), one significant way of influencing the skills, knowledge and values of teachers is to change the form and content of their initial training. This stems from the fact that many teachers lack adequate skills when they come out of training (Kuyini & Desai, 2008; Agbenyega & Deku, 2011). Consequently, mentorship is a strategy often adopted to fine-tune such newly trained teachers in line with the requirements of the school and curriculum. According to Sergiovanni and Starrat (2002), mentoring is intended to help new teachers to successfully learn their roles, establish their self-images as teachers, figure out the school and its culture, understand how teaching unfolds in real classrooms, and achieve other goals that are important to the teachers being mentored. Mentoring is also intended to help new teachers improve upon their effectiveness in demonstrating the schools' standards for teaching (Heeralal, 2014).

V. Professional Learning Communities

Another technique that strengthens teachers' competence is the organization of professional learning communities. Such learning communities tend to serve two broad purposes: (1) improving the skills and knowledge of educators through collaborative study, expertise, exchange and professional dialogue and (2) improving the educational aspirations, achievement, and attainment of students through stronger leadership and teaching. For example in the United States, Darling-Hammond and Richardson (2009) consider professional learning communities as a new paradigm in which teachers work together and engage in continual dialogue to examine their practice and student performance, and to develop and implement more effective practices. According to Vescio, Ross and Adams (2008), the main premise of professional learning communities is that student learning improves. It is a platform for teachers to share knowledge in respect of their practice. Knowledge of practice is a type of knowledge generated when teachers investigate learning and teaching in their own classrooms and school sites, which could be a form of school - based teacher development (Ruthven & Goodchild, 2008; Sowder, 2007). Most of the time, teachers value the knowledge that arises from such activities because the outcomes are personally significant and context- specific (Putnam & Borko, 2000).

VI. The Issue of Teacher Identity

Teachers' professional identity is also seen as a core process in the development of an effective teacher (Alsup, 2006). Lasky (2005) claims that "teachers' professional identity is how teachers define themselves to themselves and to others. An understanding of 'teacher identity' and the factors that influence it, is critical both for designing appropriate teacher education programmes and for the effective implementation of education policies generally (Mansaray, 2011). To further buttress these assertions, Anamuah-Mensah (2011) is of the view that knowing one's self is as critical to teacher development as knowing your subject, your students and your pedagogy, and that good teaching requires the development of teacher identity. The relevance of the concept of teachers' professional identity emanates from its relationship to professional knowledge and action, and in the assumption that who we think we are influences what we do (Watson, 2006). Researching the concept of teacher identity can lead researchers to gain a deeper understanding of the factors that influence a teacher's decisions and attitude towards teaching (William, 2007). For Beauchamp and Thomas (2009), they acknowledge the importance of teachers' professional identity as "a frame or analytical lens through which to examine aspects of teaching".

The components which describe teacher professionalism, namely professional knowledge, values, skills and reflective practice, are virtually the same rubrics which describe teachers' professional identity (Yidana, 2014). These rubrics can therefore serve as a framework for teacher education curriculum as well as bench marks, to describe the ideal teacher and to gauge teacher competence. Sharing similar perspectives, Olsen (2008) posits that teacher identity is a pedagogical tool that can be used by teacher educators and professional development specialist to make visible various holistic, situated framings of teacher development in practice.

VII. Teachers' Professional Competency Benchmarks - Professional Knowledge

Professional knowledge in this context transcends the mere mastery of the content of a specific subject. Researchers (Shulman, 1986; 1987 & Bomme, 2001; Lawal, 2006, 2011) distinguish between teachers' subject-specific content knowledge, subject-specific pedagogical content knowledge and psychological-pedagogic knowledge. Content knowledge is conceptualized as a deep understanding of the content to be taught (Baumert et al, 2010), pedagogical content knowledge is considered as the knowledge necessary to make this content accessible to students (Hill, Rowan, & Ball, 2005; Krauss et al, 2008), while psychological-pedagogical knowledge is perceived as the generic, cross-curricular knowledge needed to create and optimize teaching and learning situations (Voss, Kunter, & Baumert, 2011). Mishra and Koehler (2005) have also espoused what they term as technological pedagogical content knowledge. This is defined as teachers' knqwledge about the latest technologies used in the classroom to promote effective teaching and learning. Moreover, a teacher should be in a position to approach the subject being taught with specific questions, such as which social norms are connected to the subject, what is its relation to social issues and its value in everyday life (Kennedy, 1990). The teacher should as well be knowledgeable in the current developments and trends in his subject area (Lawal, 2006; 2011 & Yidana, 2011). Knowledge of these core domains is as important for the teacher as knowledge of their interrelationships.

VIII. Professional Values

Values are often conceptualized as aspirations or driving forces, not openly articulated, which effectively shape people's lives and determine where they will direct energies and what they hold to be of importance. They are the guideposts of our lives, and they direct us to aspire to who we want to be. In the context of the teaching profession, values can be defined as the ideals or beliefs that the profession holds as desirable or undesirable. Some of the values which the teaching profession holds desirable include moral uprightness, total commitment to the teaching of one's subject area, demonstrating positive attitudes towards students, emotional stability and transparent honesty. Teachers' participation in professional development programmes, maintaining a collaborative working relationship with colleagues, inspiring students, establishing good rapport with parents and demonstrating a belief in one's ability to influence students' academic achievement, are desirable values in the teaching profession which promote quality teaching and learning as well as the overall teacher competence.

Competent teachers reflect on their teaching and exemplify virtues they seek to impart to students, including life¬long learning, tolerance and open-mindedness, as well as intellectual capacities as careful reasoning, logical reasoning and analytical thinking and problem-solving (Darling-Hammond, 2006).

IX. Professional Skills

Professional skills are the prescribed techniques, strategies and approaches that are often used by teachers to facilitate and promote effective teaching and learning in their respective subject areas. Teachers' professional skills as a domain of their identity comprise the skills of instructional planning, skills of instructional implementation and skills of assessing students' learning (Lawal, 2006). The skills of assessing students' learning needs, preparation of lesson plans and schemes of work, selecting and sequencing any given content and improvising instructional material are part of the instructional planning processes. Skills of effective communication, class management, pacing of verbal interactions, ensuring active student participation and the logical delivery of content, cumulatively facilitate instructional implementation. With respect to the skills of assessing students' learning, the teacher ought to appreciably demonstrate the skills of alternating low-order questions with high-order questions during instructional sessions, skills of constructing essay-type and multiple-choice test items, skills of harmonizing evaluation questions with instructional objectives and the skills of promptly giving formative feedback to students on class exercises. To a large extent, these three categories of professional skills could improve teacher competence. The identity of a teacher is partly derived from the uniqueness of his or her skills that are used to perform assigned roles (Yidana, 2014).

X. Reflective Practice

Reflective practice involves reviewing and analyzing one's experiences for the purpose of learning from that experience. It is a professional development technique which enables individual practitioners to become more skillful and effective (Osterman, 1990). Reflective practice is now a key competency strategy adopted in initial teacher training programmes (Richard, 1990). Reflective practice enables teachers to take well-informed instructional decisions which ultimately improve teaching and learning. Larrivee and Cooper (2006) are of the view that reflective practice can free teachers from routine instructional practices. They argue that when teachers teach in a routine fashion, they follow the designated textbooks or teach a lesson in the same way it was taught in the past without any effort to change or innovate. However, this mechanical way of teaching, according to Mckay (2002), results in ineffective lessons and teachers become slaves to routine. According to Mckay (2002), reflective practice can influence an improvement in the overalh teaching practices of teachers. Perhaps it is on account of these benefits that Lawal (2006; 2011) recommends that ideally, teachers should reflect on the indicators of each of the three rubrics of teachers' professional identity/capacity (professional knowledge, values and skills). The preceding discourse on teachers' reflective practice has shown that it is an integral aspect teachers' competency.

XI. A 3-Paradigm Process Approach: From Theory via Praxis to Practice

Curriculum theorizing has to do with philosophizing, conjecturing and understanding the complexities of curricular issues, techniques, paradigms and developments at its frontiers. The nature and essence of teacher education demands that curriculum theorizing should be of direct and practical relevance to classroom teachers. Good practice is based on theory, and ushers in the concept of 'praxiology'. Praxeology is derived from the Greek word 'praxis', meaning 'a doing' or 'an action'. Praxiology is the key to competence in education and other purposeful education at all levels (Adegoke, 2015).

The core competency indicators as discussed in each of the four rubrics {professional knowledge, values, skills and reflective practice) are the ideal competency benchmarks as espoused by Lawal (2006; 2011). They are theoretical constructs and constitute the first step of the 3-paradigm process approach. From the theoretical point of view, these competency indicators describe who an ideal teacher is. However, the extent to which these indicators could be implemented or realized is yet another problem. Consequently, a comprehensive battery of indicators, carved out from each of the four rubrics is subjected to scrutiny by teacher educators, teachers, curriculum experts and other relevant stakeholders of teacher education. The consensus reached among these stakeholders in respect of the possibility of implementing such core competency indicators constitutes the second stage of the 3- paradigm process approach. Herein, they are referred to as the perceived professional capacity indicators which are the components of the core achievable, executable or realizable competency indicators of the teacher. At this last stage of the model, curriculum aims, goals, objectives and content of teacher education could then be fashioned out from these achievable and realizable capacity indicators.

Each of the four rectangular boxes at the lower part of Figure 1 is considered as an ideal professional capacity indicator. Theoretically, they are perceived as indicators of an ideal professional teacher. Immediately above these four rectangular boxes is a single rectangular box which contains the relevant stakeholders of teacher education and development. At this stage, a process of validation in respect of the implementation of these core competency indicators takes place. Those that are validated are then referred to as perceived capacity indicators and which later becomes the core achievable professional capacity indicators

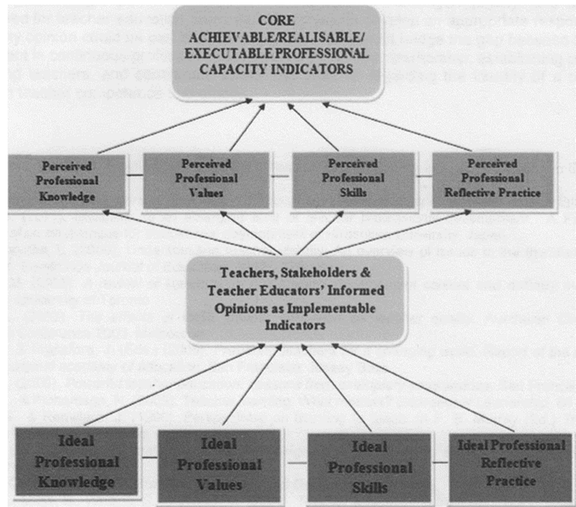

Figure 1: Lawal - Yidana (2013): A 3 - Paradigm Approach to Teacher Education Curriculum Content **Implications for Teacher Education Curriculum Goals and Content**

The most visible implication associated with this model is the need to adopt expert consensus building approach to the derivation of teacher education curriculum content and goals. Carefully selected stakeholders like teacher educators, policy makers, teacher education researchers, both locally and internationally could be consulted to build consensus on relevant indicators of each of the core rubrics of teacher competency. Afterwards, implementable, attainable and realistic curriculum goals and content could be fashioned out of such indicators.

Technological content knowledge should be integrated into the teacher education curriculum. Teacher education institutions should stimulate the use of Information Communication Technology (ICT) in the teaching and learning process. Global trends in teacher education curriculum suggest the inclusion of Technological Pedagogical Content Knowledge (TPCK) as part of teacher preparation programmes. This further suggests the need for teacher educators themselves to be abreast with the nitty-gritty of this paradigm.

Substantial evidence points to the fact that teacher quality and teachers' ability to reflect on their instructional practice critically affects students' learning outcomes (Darling-Hammond, 2006). Dewey (2010) is of the view that reflective practice involves that of suspending judgement or action until such time that more information is gathered and examined. The idea is to engage in a process of active inquiry or action research in an effort to generate new information to support or dispute existing thoughts or practices. These assertions in respect of teachers' reflective practice imply that the goals and content of teacher education curriculum should foster in teacher trainees, habits self- directed studies or action research. Teachers are "expert knowers" about their students and classrooms. Based on a careful and critical examination of their own professional practices, they are capable of generating knowledge that could enhance teaching and learning.

In line with this paradigm, any teacher education curriculum which is desirous of rolling out realistic, relevant and achievable curriculum goals and content should incorporate all the indicators of teachers' professional capacity and subject them to all the processes suggested in this paradigm. Which set of professional values are worthy of possession and practice by our teachers? Issues of the affective domain such as values are not explicitly taught but inculcated. Teacher education instructional programme should be structured in such a way that teacher educators could always involve their teacher trainees in classroom activities such as games, discussions, brainstorming, role- playing and cooperative learning. These techniques could inculcate desirable values such as positive attitude, commitment, honesty, cooperation, respect and love.

XII. Conclusion

Darling-Hammond and Bransford (2005), Hammerness (2006), Korthagen, Kessels, Koster, Langerwarf, and Wubbels (2001), Niemi and Jakku-Sihoven (2006) have all identified gaps between theory and practice as the core problem for teacher education. The apparent lack of congruence between school-based practice and the academic content in teacher education programmes partly explains why graduating teachers are net adequately prepare a to meet the needs of different learners groups in the classes. Lunenberg and Korthagen (2009), and Mason (2009) have encouraged the need for teacher education curriculum designers to develop an appropriate response to this problem. This paradigm in my opinion could be part of such responses that should bridge the gap between theory and practice. Teacher engagement in continuous professional development activities, mentorship, establishing professional learning communities among teachers, and continuous awareness creation regarding the identity of a professional teacher could help maintain teacher competence and quality.

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Application Development Using WPF

S. Mihajlović, E. Brtka
University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
mihajlovicsinisa25@gmail.com, eleonorabrtka@gmail.com

Abstract – This paper describes developing applications using Windows Presentation Foundation (WPF) at Technical Faculty "Mihajlo Pupin" in Zrenjanin, Serbia. WPF architecture is described, and what it consists of. The advantages of WPF versus Windows Forms are compared. The use of XAML in WPF is described, and how important is its role.

I. Introduction

Windows Presentation Foundation (WPF) has many applications and teaching capabilities. It is used in secondary schools, as well as at higher education institutions to improve the quality of teaching and knowledge. Students are familiar with Windows Forms, so it's easier for them to accept WPF. WPF is used in classes because it is newer than Windows Forms, and because it has a greater ability to design applications.

WPF is the latest Microsoft desktop application development platform, released in 2006 under the name Avalon [1]. WPF is a replacement for Windows Forms. WPF uses new concepts, and some of them are XAML (*eXtensible Application Markup Language*). XAML is a tag language used to specify the application's user interface. Separate use of UI and application logic makes it easier to develop and design an application. Developers use Visual Studio where they can create interaction or business logic, while graphic designers use Expression blend to design a XAML user interface. WPF enables fast application development and more flexible product from Windows forms, because it has more functionality. The main features of WPF are animations, 3D, skins/themes that may not be used to develop business applications. UI applications become interesting and have a more attractive design. Graphics serve users to visualize the options presented to them [2].

WPF is usually used to develop business desktop applications. WPF brings fundamental changes and is a powerful framework for building Windows applications [3]. WPF integrates framework capabilities, including User, GDI, GDI+, and HTML, and is influenced by web-based tools such as Adobe Flash [4].

II. WPF Architecture

The WPF architecture consist of two frameworks, one managed and one unmanaged. All the functions needed to create a WPF application, such as controls, layout, data binding, and visuals are called the presentation framework that is in the manageable API. Functionality such as composition and rendering are found in an unmanageable API and is called a Media Integration Layer (*MIL*). The MIL displays all the pixels, and it represents the heart of the presentation mechanism [3]. Figure 1 illustrates the various components that make up the WPF architecture.

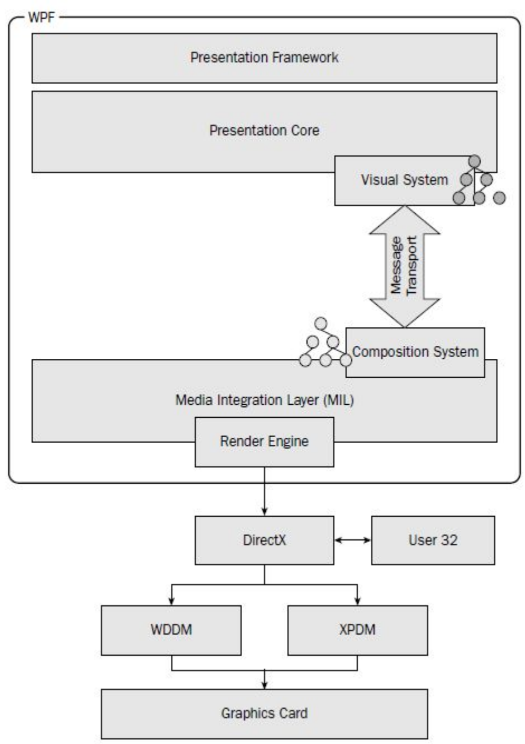

Figure 1. WPF architecture [1]

The basis of WPF are DirectX, User32, display drivers (*WDDM and XPDM*), and a graphics card. All software rendering ends with a graphic card. In addition to display drivers, DirectX is used for rendering 2D, 3D, text or animation, while using the maximum strength of the graphic processing unit (*GPU*). User32 manages the windows on the desktop. MIL is above User32 and DirectX and analyzes visual data to display the user interface. Between the MIL and the presentation framework is a Presentation Core. The application tree that represents the user interface makes a visual system that provides classes that represent visual representations. The primary API used to create a WPF application is the presentation framework that is at the top of the WPF architecture. The compositional system is responsible for the compilation of all visible visual elements of the application on the screen. Transport messages provide a two-way communication channel located between the visual and composition system [1].

III. XAML

XAML is a declarative language and is intended to design a user interface and layout. It is always used with other programming languages such as C#, VB.NET, C++, and others. XAML, combined with other programming languages, is used to create desktop, tablet or mobile applications with a unique user interface. The design could not be achieved before the introduction of XAML and WPF [5]. Figure 2 illustrates XAML code in Main.xaml.

```xml
<Window x:Class="MouseUp.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
        xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
        xmlns:local="clr-namespace:MouseUp"
        mc:Ignorable="d"
        Title="MainWindow" Height="450" Width="800">
    <Grid Name="pnlMainGrid" MouseUp="pnlMainGrid_MouseUp"
          Background="LightBlue" MouseDown="pnlMainGrid_MouseDown">
    </Grid>
</Window>
```

Figure 2. XAML code

XAML is an essential part of WPF. Regardless of whether a window or page is being created, it consists of an XAML document and code behind file, which together creates a window/page. The XAML file describes the interface with all its elements, while code behind manages all events and has access to manipulate with XAML controls [6]. Figure 3 illustrates the code behind in the file.

```csharp
public partial class MainWindow : Window
{
    public MainWindow()
    {
        InitializeComponent();
    }
    private void pnlMainGrid_MouseUp(object sender, MouseButtonEventArgs e)
    {
        MessageBox.Show("Kliknuo si na mene " + e.GetPosition(this).ToString());
    }

    private void pnlMainGrid_MouseDown(object sender, MouseButtonEventArgs e)
    {

    }
}
```

Figure 3. Code behind file

Visual Studio IntelliSense works in XAML files very well, because while typing you get the ending of the tag, the completion of the attribute and even the completion of the value. The XAML basics include namespaces, elements, properties, events, and attached properties. XAML is powerful and flexible, and it is crucial for creating user interfaces, and it enables interaction with users [7]. Most modern UI frameworks are guided by events as well as WPFs. All controls, including the window which also inherits the control class, are exposed to a series of events. The application will be notified when events occur and will react to it. There are many types of events, but some of the most commonly used are to respond to the user's interaction with the application using a mouse or keyboard. A control event in XAML relates to the code part in a file that is behind the code [6].

IV. WPF VS. WINDOWS FORMS

The most important difference between Windows Forms and WPF is that Windows Forms is just a layer above standard Windows controls, and WPF is built from scratch and does not use the Windows control standards. The best example is a button with pictures and text on it. It's not standard control, and Windows Forms does not have this capability, and instead you have to draw a picture, implement your button that support images or uses third-party controls. With WPF, the button can contain anything, and like most other WPF controls, it can contain a few other controls inside it. The button only needs to set the Image and TextBlock control inside the button [6].

WPF advantages:

- It is newer and therefore more consistent with current standards.
- Microsoft uses it in many new applications, e.g. Visual Studio.
- It's more flexible, so you can do more things without writing or buying new controls.
- When it is necessary to use the third part of control, programmers of these controls will be more focused on WPF because it is newer.
- XAML makes it easy to create and edit a graphical interface and allows sharing between designers (XAML) and programmers (C#, VB.NET, etc.)
- Linking data, allows you to get clearer separation of data and schedules.

- Use hardware acceleration to draw GUI for better performance.
- Allow you to create a user interface for Windows applications and web applications (Silverlight/XBAP) [8].

Windows Forms advantages:

- It is older and more experienced and tested.
- There is already a lot of the third part of controls that can be purchased or obtained for free.
- The designer in Visual Studio is still better at writing when it is better for Windows Forms than WPF, it needs to work more with WPF [8].

V. Conclusion

WPF was well accepted by students. In addition to the new knowledge they have gained, students have innovated the approach to application development. This is of great importance for students and shows the possibilities that WPF provides in education. The use of WPF is growing in relation to Windows Forms because it uses animations, 3D, skins and themes. It is easier to create a layout of the elements, as well as the design itself, all of which is enabled using the programming language XAML.

Visual Studio IntelliSense makes it easier to use XAML because it completes the writing of the elements used. The design is separate from the events that are written in the code behind where C# is used to create individual events. In the part of the code where XAML connects are events with the code behind that are defined. The most important thing is that WPF is newer than Windows Forms, and that it is easy to use and programming.

Acknowledgment

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The First Experienses in Use of Teacher Logbook in Sombor Municipality Schools

M. Bogdanović*, S. Mironicki*, A. Tomić**
*Secondary technical school Sombor
**Primary school "Ivo Lola Ribar" Sombor

Abstract - The paper presents research results on teacher logbooks, impressions and observations of their users. The survey involves three beneficiary groups: teachers, parents and school principals, pedagogues, in primary and secondary schools in Sombor municipality. The research was carried out by use of a questionnaire whose main subjects are related to availability and types of information, but also efficiency and transparency in searching the logbooks and making reports.

I. Introduction

The use of teacher logbooks is promoted by Ministry of Education, Science and Technological Developmentin in 2017. In accordance with Article 174, paragraph 5 of the Law on the Foundations of the System of Education and Upbringing [1], the school administrations are informed that records on pupils, parents and other legal representatives are to be kept electronically.

The research direction was influenced by the publicly expressed expectations of the ministry [2], but also by the topics promoted in [3] and [5].

The paper presents research results on impressions and observations of electronic logbooks users. The research was done by surveying six primary (some of which have seen the introduction of teacher logbooks during the previous school year, therefore it was the only one used this year) and three secondary schools (only introduced this school year and is used in parallel with regular logbooks).

Three group of users have been surveyed:

1. Teachers, who are in charge of keeping records of all aspects of the teaching process, i.e. inputting basic teacher logbooks data, but also use said data for making reports and cooperation with parents.
2. Parents, who use data to gain insight of the work done and results achieved by their children.
3. School principals, pedagogues and psychologists, who use the data to follow the teaching process and make reports.

The questionnaire was created in accordance with the research direction. The questions aim to demonstrate how equipped the schools are for teacher logbooks implementation, as well as the level of teachers' and parental readiness and willingness to use it. Also, all the groups have been asked to give their opinion about availability and layout of e logbooks data, as well as its influence on teaching and conduct.

The research included 185 people, 107 of which were teachers, 10 members of management staff, 16 pedagogists and psychologists, as well as 52 parents.

It is important to mention that most people were reluctant to take part in the survey, so some of the questionnaires were only partially filled out.

II. Results of Education Employees Survey

In secondary schools, 77 teachers were surveyed, 42 of whom taught general and 35 taught vocational subjects. In primary schools, the number of surveyed teachers was 30, 12 of whom were class teachers and 18 subject teachers. Even though teachers were split into four groups, their answers to most of the questions did not differ significantly. The survey also included 6 school principals, 4 principals' assistants, 6 pedagogues and 10 psychologists.

Only 9 secondary school teachers (11%) can access teacher logbooks from their classrooms, 67 (84%) can access it from staffrooms, while 4 of them (5%) stated that they had no teacher logbooks access while in school. Primary schools fared much better; 25 teachers (83%) confirmed they had access from every classroom, only 3 (10%) had access from staffrooms, while 2 (7%) had no access at all.

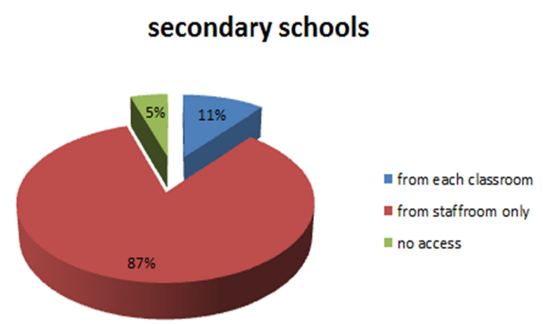

Figure 1. Secondary schools

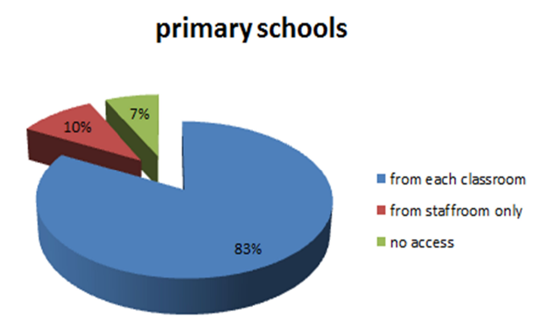

Figure 2. Primary schools

When asked about the frequency with which they fill out teacher logbooks, secondary school teachers were as follows: 23% do it while in class, 52% at the end of the day, 25% once a week, 1.2% do not fill them out at all. In primary schools, the situation is as follows: 20% of teachers fill them out while in class, 40% at the end of the day, 40% do it once a week (Figure 1, 2 and 3).

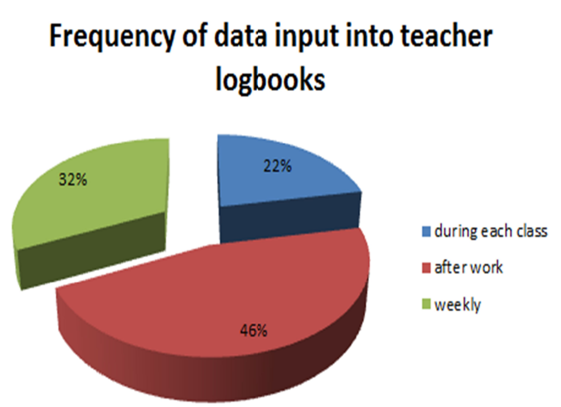

Figure 3. Frequency of data input into teacher logbooks

Principals, pedagogists and psychiatrists were asked the same question and their answers varied. 5 school management staff members used teacher logbooks daily, 2 of them used it weekly and 1 occasionally. Among the pedagogues and psychologists, teacher logbooks usage was daily in 5, weekly in 3 and occasional in 6 cases. One of them had never used it. In actual fact, psychologists and principals do not need to use teacher logbooks with great frequency, merely to form reports, but it does offer plenty of much needed information for pedagogists and principals' assistants.

Since teacher logbooks gives the option of formative grading while teaching, teachers were asked whether they use it. Unfortunately, only 4 primary school teachers do so while in class, most of them, 38, only occasionally, while 31 of them do not use teacher logbooks for formative grading. This result matches the inability to access teacher logbooks while in class (only 9 teachers were able to do it). Situation is much the same in primary schools, despite better technical conditions; 18 teachers use teacher logbooks for formative grading, while 12 of them do not.

The grade note option is, unfortunately, used by few teachers, regardless of school. Only 13 out of 107 (12%) enter notes after grading, 42 (39%) do it occasionally, while 48 (45%) do not enter them at all. This research has shown that most parents consider this piece of information to be important and necessary.

Teacher logbooks has not helped in simplification of personal records, which teachers are required to keep. Only 7 teachers do not keep records aside from teacher logbooks, while the other 100 have at least two backup copies of their activities' logs. When inquired about reasons for doing so, they provided a number of interesting answers:

4. Being obliged to
5. For better navigation (where what is)
6. I like it that way
7. It has more details
8. It's faster
9. It's easier to show it to parents
10. I do not have absolute trust in technology
11. It's more reliable
12. It's more accessible
13. I can follow student's progress
14. It has better layout
15. It's simpler
16. I do not fill out teacher logbooks in real time
17. It's important
18. The subject I teach is specific
19. It's easier for me and I feel reassured
20. I also want a hard copy of the records
21. I can't make it while in class
22. No Internet access in classrooms

When asked about teacher logbooks data layout, 86 teachers were content, while 19 believed data was not well laid out. Reasons for bad layout can be divided into two groups: the first one consists of answers regarding limited access to data and a manner of data grouping being different from traditional logbooks; the second group consists of answers regarding extra time necessary for data searching. Executive officials are happy with layout, with a single exception, who stated that when it comes to students lower on the list, the "show grades from all subjects" option does not display the name of the subject.

When it comes to accessibility, 86 teachers rated teacher logbooks data as easily accessible, while 14 believe the opposite. Management staff, pedagogists and psychologists are of similar opinion, but their insight is more detailed. They are of the opinion that no summary, school-wide, data exists for first and second semester, that class-level reports are not in accordance with report demands from Ministry of education, Provincial secretariats, Provincial administration, Department of statistics, data is not systematised, there is no option to unify it on a school-wide level.

The influence of teacher logbooks on the teaching process has been analysed through 4 questions.

1. Has the approach to teaching been altered since the beginning of teacher logbooks use?

98 teachers are of the opinion that is has not, while 6 believe it has, due to extra time required for data input, which is another imposed, time consuming task, but there are those who believe that data examination is now easier. Principals, pedagogists and psychologists are mostly of the opinion that approach has remained the same, but 6 of them give insight into perceived differences: positive changes are brought on by improved data accessibility, which enables improved work planning; also, teacher logbooks acts a little bit as teachers' "conscience". Negative changes, on the other hand, are a consequence of additional time required for data input, which cause a mild pushback by the teaching staff.

2. Is subject grading more objective without insight into other subjects' grades?

64 teachers believe that lack of insight into other grades is a positive thing, which leads to more objective grading, while 40 of them do not believe it has any impact on their objectivity.

3. Are you of the opinion that teacher logbooks will improve student grades?

Mere 9 teachers believe it will, since parents will gain insight into students' grades sooner and will be able to monitor their progress with increased regularity. The remaining 100 teachers are of the opinion that teacher logbooks will have no impact on students' grades. Management staff, pedagogists and psychologists are in agreement with teachers, except for 4 cases, where the opinion was that improved parental insight into student grades would have a stimulative effect on students, but also that teachers would better plan and evaluate their own work.

4. Do you believe that teacher logbooks will improve students' conduct?

Again, 9 teachers believe that it will, due to parents having daily access to notes about students' potential absence from classes, conduct, rule violations, which will lead to parental pressure, but the remaining 100 teachers are doubtful about its influence. The divide among principals, pedagogists and psychologists is very similar, with only 4 of them being having confidence in positive influence, due to improved parental oversight.

The final question was regarding teacher logbooks influence on administrative work. 4 answers were offered: it will speed up, slow down, increase in volume, or decrease in volume. Everyone was asked to pick two, but not all teachers did it properly. The answers are as follows: 52 teachers believe the administrative work will speed up, 38 that it will slow down, 50 believe the volume of work will increase, while 27 believe it will decrease. Executive officials mostly expect administrative work will speed up (8) and decrease in volume (7). Opinions of pedagogists and psychologists are divided.

Finally, a list of suggestions regarding data that is required by school employees, but is missing or has to be improved:

23. Ability to access all subjects' grades
24. Filling in missing data regarding physical education
25. Missing data about students' family social structure
26. Allowing independent correction of errors or add additional time during which they can be corrected
27. Missing compulsory data that has to be entered into tables when applying for competitions, seminars, camps…

28. Missing parental insight log
29. Simplification of remedial/extra classes input
30. Easier tracking students' absence from other classes
31. Improvement of class swapping regulations (for example, if one teacher takes over another group from their colleague, teaching two groups at the same time, teacher logbooks only shows their group, making them unable to note which students are absent)
32. Ability to sum up school-wide grades, admonitions, absence for all classification periods
33. Ability to send messages or e-mails to parents or other teachers who need to be notified of something
34. Facilitation of logging changes in teaching dynamic – making up for lost classes due to work stoppages, substitutions, shortened periods.
35. Missing data regarding students' mobility (changing schools etc) for the duration of a particular school year and entire education.

III. RESULTS OF PARENT SURVEY

The questionnaire for parents was conceived in a different manner, but they too were asked some of the questions already mentioned, in order to compare to the answers of school employees.

When asked about the frequency with which they accessed teacher logbooks, 28 parents answered that they access it once a week, 18 of them do so once a month, 4 of them do not do it at all, while only 2 parents monitored events on a daily basis (Figure 4).

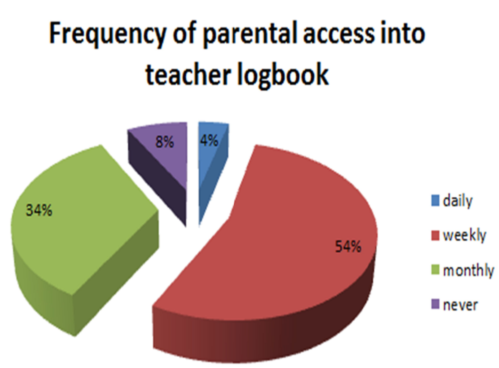

Figure 4. Frequency of parental access into teacher logbook

Despite being interested in data provided by teacher logbooks, 44 parents believe speaking to a class teacher, class master or subject teacher directly is necessary, which is why 32 of them did not reduce the frequency of their school visits. Face to face contact is important, since nothing can replace live communication; this is merely a service, plastic way of getting information; it facilitates possible consultations, excusing absences, problem solving, giving guidelines for practice and grade improvement. Parents have expressed interest in other school events as well.

Parents are mostly content with the data provided by teacher logbooks. Only 14 parents have complained about data delivered with delays and being incomplete, missing entries about competitions, extracurricular activities, relationships with other children etc. Besides grades themselves, grade notes are also important, since 48 parents (92%) wanted to know how a grade was earned (oral or written exam, class engagement, practice). Grade dates were less important; parents' answers were split down the middle on this issue. Most parents are not of the opinion that teacher logbooks will students' performance; only 7 of them (13%) believes that continuous insight into grades, notes and remarks will have a positive impact. Much the same influence, or lack thereof, is expected on student's conduct, i.e. only 8 parents (15%) believes their regular oversight of teacher logbooks will cause improvement.

No changes to approach to teaching have been observed by the parents, but having insight into the content of classes already taught is considered a necessity.

What follows is a list of information that parents would like to see in teacher logbooks:

36. Conduct of a child
37. Child's relationship with teachers
38. Relationships with classmates
39. Notifications of written exams, tests, competitions, invitations for applications, etc
40. Criticism or praise for engagement during classes
41. Notifications of taking part and success achieved in student competitions
42. Interesting facts from classes
43. Grades being better laid out and presented in tables
44. Activities

IV. CONCLUSION

A conclusion can be drawn that schools are insufficiently equipped for teacher logbooks use and that teachers do not input data in a timely manner. Despite being better technically equipped, primary school teachers do not fill out teacher logbooks while in class. Teacher logbooks cannot be made to function in real time yet.

Most of the participants has expressed content with data contained in teacher logbooks, as well as its layout and accessibility. Parents' and school employees' opinions differed on one issue; parents preferred to see how a grade was earned, i.e. grade notes, while teachers admitted to making those only occasionally. Although there is widespread support for modern trends, innovations, introduction of IT into school administration, participants are in agreement that teacher logbooks will not have a significant impact on either teaching quality or student achievements. Parents are convinced that face to face contact is, after all, irreplaceable. The questionnari conclusions differ from official attitudes in the ministry of education, where the following is stated: the absence from classes is already reduced in schools where exclusively teacher logbooks are used [4].

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Advantages and Disadvantages of E-Class Registers (Teachers' Logbooks)

Z. Zeljković*, D. Musulin Kolarov **, D. Žigić*, J. Stojanov***
* Primary School Vuk Karadžić, Novi Sad, Republic of Serbia
** Primary School Vasa Stajić, Novi Sad, Republic of Serbia
*** University of Novi Sad, Technical Faculty "Mihajlo Pupin", Republic of Serbia
zoricazeljkovicmatematika@gmail.com, dragica.musulin@gmail.com, zigicddragana@gmail.com, stojanov.jelena@gmail.com

Abstract – In this paper will present the results of the surveys conducted among teachers, students and parents regarding the use of E-Class Registers in schools in Serbia. The survey has been conducted in two primary schools in Novi Sad.

I. INTRODUCTION

In every Elementary school law in the past 2 decades, there has been an article about digital competence. It also exists in the latest law where the digital competence is: the self-confident and critical use of information and communication technologies for work, rest and communication [1]. Over the past decades, there have been attempts to introduce E-Class Registers in our country and in the countries of the region. [2].

Those have been random attempts of introduction of E-Class Registers either in one particular school or in a couple of local schools. [3]. The schools which introduced the E-Class Registers found it easier and faster to inform parents about students' achievements. Since it was only a local novice, schools would very soon stop using E-Class Registers due to various technical and material reasons.

From the school year 2019/20 all schools in Serbia are switching to the E-Class Registers. In autumn 2017, a number of schools in Serbia entered the pilot project E –logbooks. Among them are Primary Schools "Vasa Stajic" and "Vuk Karadzic" where a survey among teachers, parents and students was conducted. This work was written on the basis of a survey conducted in two primary schools ("Vasa Stajić" and "Vuk Karadžić") From September 1st 2018., both of these schools have only worked with an electronic logbook, while, during the last school year teachers worked with a comparative record keeping. Both teachers from 1st to 4th grade and teachers from 5th to 8th grade used E-Class Registers and paper record books at the same time. Training for the E-Class Registers was organized only for coordinators. Further training in these two schools was organised in the following way: the coordinators organized several different trainings to the groups of teachers of similar subjects as well as one on one tutoring.

Prior to starting E-Class Registers each user practised in demo version, the so called red version. In this paper we are going to present you with the experience of the teachers, students and parents after one year of use. After nearly 2 years of use we were interested in users' experience. The focus now is on the students' marks, behaviour including absence as well as how accurately students provide this information to their parents.

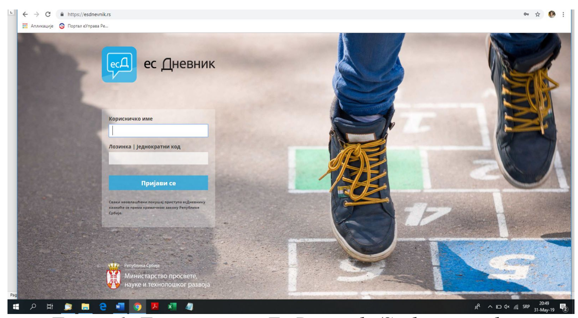

Figure 1. Front page to Es Dnevnik (Serbian teachers logbook) access

II. SURVEYS

Starting points – at the moment of starting E teachers' logbook

At the time of entry into the pilot project, the age of teachers of elementary schools "Vasa Stajić" and "Vuk Karadžić" is the middle age structure, with an average of 20 or 24.8 years of working experience. This may have been one of the factors why teachers might have been reluctant to the new system, or the use of the E-Class Registers. During the first half of the year of "practicing" teachers learned the benefits of E -logbooks. Being the only logbook in use since this September we were interested to hear the experiences of teachers. In addition, at the moment of entering this pilot project, the elementary school "Vuk Karadzic" did not have the internet and computers in each classroom, but right before the start and in the period of exercising in the demo version with the help of their own resources and the engagement of the administration, as well as the donations, each classroom was equipped with the internet and computers to be used by teachers to enter necessary data in E-Class Registers.

A. Parents and students

Parents got the access to teachers' logbooks only in spring term, so their answers may differ now to those which would have been obtained if the survey was conducted at the end of 2019.

Students showed their interest in E-Class Registers only when parents got the access to them, so their answers may be different now than the answers they are going to give in a year if the survey is conducted again.

B. About the survey

The survey was conducted in both schools among all teachers of all years. The survey was distributed to teachers on Google drive. The sample that was analysed here consists of 62 users.

It was agreed that parents' and pupils' surveys would be conducted only among interested parents of grade 7 students. The sample for parents includes 116 parents while the one for students includes 130 students.

Surveys were distributed to pupils and parents by professional associates at the parental meetings or the homeroom classes.

The questionnaire was intended to check the attitudes of the teachers, how the E-Class Registers feel to them, whether they make the work easier, whether they think that they have all necessary technical equipment and to try to feel the current atmosphere among the staff of these two primary schools.

When it comes to parents it was important to find out the extent in which the E-Class Registers are used, if they have decreased the number of individual teacher-parents meetings. It was also important to find out if the parents have a clearer picture and a better insight into their children's work and behaviour and if they would recommend it.

By conducting this survey among students we wanted to check if the use of E-Class Registers have changed the student-parent relation regarding parents being informed on a more regular basis by the students.

This E-Class Register option does not allow students several days to let parents know about the marks or any other remarks noted during lessons contrary to similar options of logbooks in the region which allow students three days to inform parents about the marks. [3].

C. Questions in the survey:

Questions in teachers' survey:

1. Do you have the technical support that you are satisfied with?
2. Did demo E- Class Registers make it easier for you to implement teachers' logbook in practice?
3. Do you consider it easy to use?
4. When do you most often log teaching units?
5. How often do you log students' activity in class?
6. Do you more often log negative remarks in E-Class Registers than the positive ones?
7. Do you consider it simple to use?
8. Has it made the paperwork easier?
9. Do you have a better insight into your own class?
10. Is it easier to write reports with the help of E-Class Registers?
11. Do you think it has made your work simpler?
12. Has it met your expectations ?
13. Would you recommend it to your colleagues?
14. Name three positive features of teachers' logbook.
15. Name at least one negative feature of teachers' logbook.

Questions for parents' survey:

1. How often do you use teachers' logbook?
2. Has the teachers' logbook made it easier for you to have a better insight into your child's marks?
3. Has the teachers' logbook made it easier for you to have a better insight into your child's work and behaviour?
4. Has the use of teachers' logbook reduced the number of your visits to individual parent-teacher meetings?

5. Do you find the teachers' logbook simple to use?
6. Would you recommend it to others?

Questions for students:

1. Do you skip classes less since the introduction of the logbook?
2. Do you inform your parents more regularly about the marks?
3. Are your marks better since teachers' logbook has been introduced?
4. Is your behaviour better since teachers' logbook has been introduced?
5. Do you like the fact that there is the teachers' logbook?

D. Analysis of the teachers' survey

As previously said schools have not yet received the amres network from the Ministry (internet network provided by the Ministry of Education throughout the whole school and which provides access to the Internet at any time). It means that during this school year as well as all years before we have been using the internet support which the school could provide. Schools also applied to the City Administration for Education (Finance) for the purchase of computers for the use of E-Class Registers, but the answer is still pending. So now, in our classrooms we have laptops in some and desktops in others. We were interested in how much teachers are satisfied with that. So the question is: "Do you have the technical support you are satisfied with at school?" 96.7% answered YES, and only 3.3% NO.

As mentioned earlier, this logbook had its own demo version in which teachers could practice, which made it much easier for users to use their logbooks later, and this was confirmed in the survey. 88% felt that they helped them work on the demo, the others believe that they were able to implement E-Class Registers without exercising.

Now each classroom, the cabinet has a computer. And that means that every teacher can log their teaching unit during class, as well as observations about the work of each student. At the beginning of this project, part of the teachers logged units after class or even at home. Unfortunately, now after a year of use, we have a large percentage of teachers, 37% of them logging teaching units at home, 8% logging them after school hours, while 55 % of teachers are log them in time, which we consider a small percentage.

This logbook allows the teacher to include activities about the student as a commentary during the class.

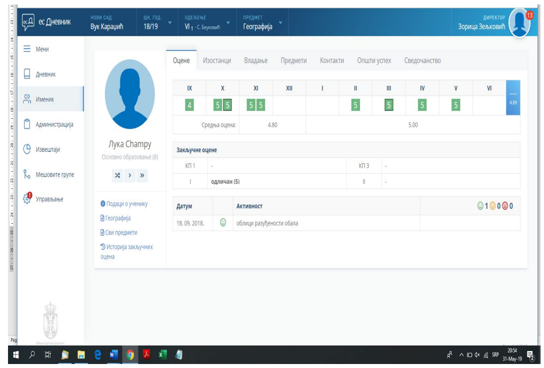

Figure 2. E teachers logbook's name page

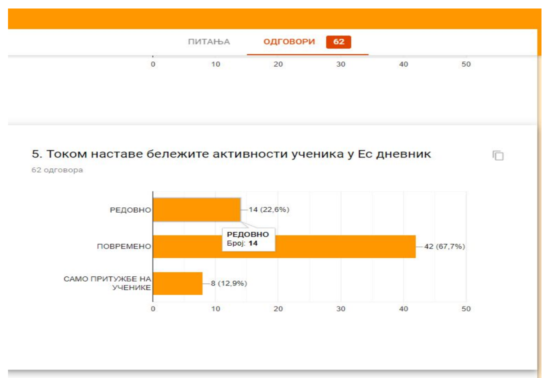

Figure 3. Graf showing the rate of logs of students' activity in class

The results show that the teachers only occasionally use this option. We wonder if the reason for that is that they did not include this as their regular classroom activity, or teachers believe it is not necessary to do it here as well since they continue to note down observations in their own pedagogical record book. We will have to address this issue more. We wonder if teachers in this way unconsciously want parents to visit them more often and regularly.

As many as 67% of teachers think they do not log more often negative reviews than the positive ones.

The Figure 4 shows that almost 60% of teachers answered that the E-Class Registers simplified their work, while 37% of them only partially agree with this , and 3% do not agree at all.

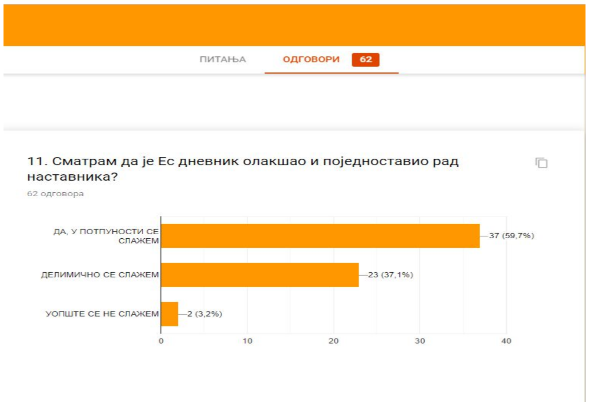

Figure 4. The extent to which teachers consider E logbooks have made their work easier

We must also point out that all teachers have confirmed that they log the teaching units without any difficulty. All teachers (100% of them) find it very easy to use the logbook. We must say that the teachers' logbook still does not have the option to enter the same teaching unit automatically if the teacher works in more than one class of the same grade. But every teacher who has their teaching units on the computer can easily log the units with the help of copy and paste options.

Another advantage of the E-Class Registers is the reduced time for regular administration, which was confirmed by 84% of teachers. We believe that this is very important because it leaves much time for the teachers to devote themselves to the process of planning and preparing of the teaching. All homeroom teachers often find it difficult to follow all the activities of their class, but with the use of the E-Class Registers this is a lot easier for the teacher, which was confirmed by 79% of the respondents.

We think that another advantage is that the homeroom teacher has a precise insight into the records at all times, for example grades marked as test or oral examination, etc. which was not the case earlier. It was impossible for the homeroom teacher to know what the grade was referring to unless they meet the subject teacher in person or contact the colleagues during their free hours. "Vuk Karadzic" is a school that has over 80% of teachers working in two, three and even five schools, which makes communication difficult and it all comes down to meetings of expert councils, classroom councils and with the teachers' logbooks this problem is overcome.

The end of terms as well as the end of the school year is a very stressful period especially when it comes to writing reports when teachers always wonder if they have remembered everything. According to the 90% of respondents, the teachers' logbook makes it easier to write reports. We believe that the reason for this is that the teachers' logbook enables us to export the data that we have regularly logged, and therefore we are sure that we have not forgotten anything. 92% of teachers think that the teachers' logbook met their expectations.

After all the enthusiasm we were wondering if they would recommend a diary to colleagues who do not use it. 72% would recommend it or agree with this claim, while 3% do not agree that it should be recommended to colleagues, and 24% only partially agrees. The teachers' logbook should be recommended to colleagues. This was an interesting fact to us, because we wondered if it meant that they did not have a stance, or it was simply that their period of using the logbook was too short to form an opinion. Considering the other responses that are in favour of teachers' logbook, we conclude that these colleagues prefer to spend more time using the E-Class Registers so they could make a decision.

E. Parents' survey

Each parent who was offered to do the survey was willing to do it.

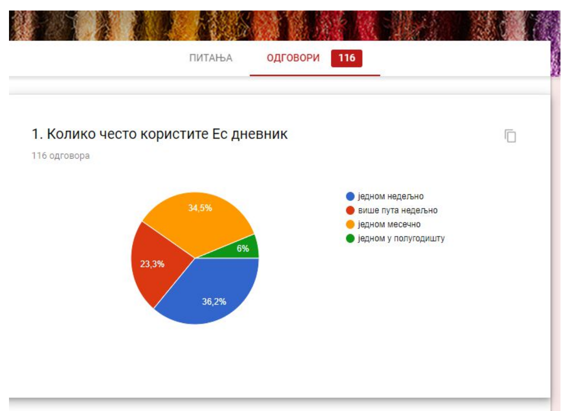

Figure 5. How often is E teachers logbook used

The chart in Figure 5 shows that 36% of parents access E-Class Registers weekly and 23% of parents access it more often and only 6% of respondents answered that they access it only once per term. We conclude that parents by a regular access to E-Class Registers unconsciously encourage children to study more regularly. We think that 59% is a high percentage and that parents still have a better insight into the work of their children. We are sure that 68 parents (which is a result of 59% of 116), do not come to individual conversations on a weekly level which was confirmed by the insight into the E-Class Registers.

As many as 81% of the parents confirmed that insight into the grades is better, while 17% think that there is no better insight. We believe that this information will be indirectly checked through the average marks of the as well as the individual student averages (Achievements realised). The number of 76% of parents confirmed that they have a clearer picture of the behaviour of their child. In fact, this is what we conclude by the reduced number of disciplinary measures imposed, as well as the reduced number of logs in discipline record. Further, it leads to significantly lower number of low discipline marks. This is what parents confirmed in media [4].

What we all feared before introducing E-Class Registers is certainly the fact that there may be a decrease in the number of individual interviews or visits to schools. The data obtained suggests that the fear was justified.

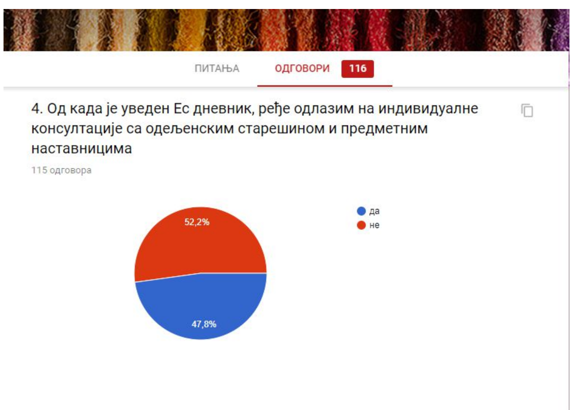

Figure 6. How much the use of E-Class Registers reduced the parents' visits to school

We see that almost 48% confirmed that they are less likely to visit school (Figure 6.). By comparing the number of individual meetings this year and last year, it has been confirmed that this year the number is significantly smaller. So we have to deal with this topic and find the ways how to attract parents to visit the school more regularly. Of course, we must point out that the number of parents at parental meetings has not been dropped, this number is in the ranking with the number of visits in previous years.

The high number of 93% of parents confirmed that E teachers' logbook is easy to use. We must emphasize here that in the territory of Elementary School "Vuk Karadzic" we have a specific social structure, a large percent of children from socially sensitive groups, and an extremely small percentage of parents who have acquired academic degrees.

3% of parents would not recommend the logbook. We consider this is not alarming and we conclude that nevertheless, the diary is very well accepted by parents.

Perhaps some specifics of the E-Class Registers should be addressed in some further survey.

F. Student Survey

The students were eager to answer a few questions that we prepared for them, see Figure 7. We were interested in whether they were ready to give realistic answers to the questions and whether they were self-critical.

When asked if they skip classes less since E-Class Registers have been introduced, 58% of them said that the use of the logbooks had no impact, 4% of them confirmed that the logbook influenced less frequent absence, while 26% said it was completely untrue that the use of E-Class Registers reduces the classes skipping.

The analysis of the survey concluded that students did not answer this question accurately in this, because when it was compared to the parents' answers as well as with the insight into the electronic diary it was obvious that the number of absences is lower. According to the survey, it can be concluded that the students regularly informed their parents about their marks even without the use of E-Class Registers. Even 46% of students confirmed this. It was noted that the significant percentage of 23% confirmed that they began to report their marks to their parents more regularly. A significant percentage of 31% thinks that this claim is partly true. We conclude that the students answered this question in a very realistic way. We were also interested in how realistic students were about the grades. If their grades are better after the introduction of E-Class Registers. Nearly 60% of them think that this is not true, while only 13% think it is true.

We could not conclude anything here because we had nothing to compare the data with. It is only certain that students are better prepared for school and they better fulfil their school tasks.

As far as behaviour is concerned, 62% of students believe that parental insights have no impact on their behaviour.

Only 4% of them confirmed that the use of the logbooks influenced the improvement of their behaviour. The most interesting question is whether they like the introduction of the logbooks. 67% of them said they did not like it. It was interesting to us that they do not like it in such a huge number and according to them, the teachers logbook does not have an impact either on their or on the regular reporting to their parents. We were wondering how realistic were the previous answers. We believe that in some of the following surveys, when the diary is longer in use, the data we receive on this survey will be more uniform, meaning that there will not be such a large percentage of answers that they do not like the introduction of E-Class Registers.

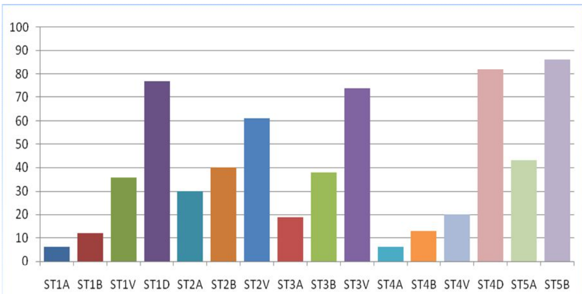

Figure 7. Students' survey analysis

III. Positive and Negative

Based on the questionnaires filled out by the teachers, the positive characteristics of the E-Class Registers are: easy to use, economical, quick, transparent, giving parents a precise image, daily informing parents of grades and behaviour, grades are available to parents at any time, provides the possibility of working at home, teaching units are quickly and easily enrolled, the subject teacher sees grades only from his subject, which contributes to subjectivity, easy entry of grades after written tasks or test, automatic calculation of the averages, simplified paperwork especially for the homeroom teacher, more time for the class itself. In addition to the above, we must point out that the use of electronic diaries in some way protects the grades and reduces the possibility of correction of those as well as the adding of marks. These are just some of the positive sides.

The negative sides that the respondents stated, include the following: the teachers logbook does not summarize the extra support classes at school level; some say that class average grades should be presented better; some have insisted that we do not have a section in the logbook where a student on duty will be noted; introduce the option that will enable the logging of the teaching unit in all classes the teacher works in once they enter the number of the unit. Some say the disadvantage is that there was not enough training. Some complain that there is no Internet at all times, and this prevents them from using of E-Class Registers. Some teachers dislike the impossibility to transfer data from one school to another automatically. One more disadvantage stated in the survey is the insufficient number of learning outcomes in the first grade of primary school, especially for mathematics. Another one is the short time to delete the grade. It was suggested that the transparency in the part of the reports should be improved, and a daily overview of disciplinary entries should be introduced. As it can be seen from the above, it is obvious that there are more positive than the negative features of the E-Class Registers. The papers from the region confirm that it is not the case only in our country. [2], [3].

IV. Conclusion

Based on this all, it can be concluded that grater majority is in favour of E E-Class Registers. Regardless of the short period of use the numerous advantages of the teachers' logbook are noticed. One of the advantages is certainly considerably faster notes taking, not wasting time, everything is in one place and transparent, etc. Of course, this version will still be redesigned in the future and thus its disadvantages will be eliminated. We believe that the schools which are about to enter the project will see the benefits of it.

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A Review of Robotic Kits Used for Education Purposes

K. Davcev, N. Koceska, S. Koceski
University Goce Delcev – Stip/Faculty of Computer Science, Stip, Republic of North Macedonia
saso.koceski@ugd.edu.mk

Abstract – The term educational robot is usually associated with systems that can be classified as robots and that are used in the process of education with a final goal to learn with, form or about it. In the last decades, due to the technological and pedagogical advancements as well as low prices of the educational robots, their usage is dramatically increased. This is also reflected in the increasing number of articles that are published in the last decades. Various education robots have different features from architectural, structural and functional point of view. Therefore, the main goal of this paper is to present a literature review of the educational robots and their characteristics.

I. INTRODUCTION

Despite the fact that the technological solutions nowadays are omnipresent, traditional opinions that they are completely depending on us and on our commands prevails. However, in the last decade, the concept of autonomy is permanently changing with a fast pace mainly due to development of Artificial Intelligence (AI). The growing popularity of the Artificial Intelligence (AI) and its application in various fields [1], starting from tourism [2], through medicine [3-5], biology [6], education [7], robotics [8-11], and also in economy [12], is mainly due to the apparatus i.e. the models and techniques used to mimic the human reasoning, learn and improve during time.

Today we are witnesses of devices that are moving autonomously in our environment on their own but, also systems that are performing tasks and working on our behalf. We can find multiple mobile systems that have significant level of intelligence, used in our daily life. Examples include autonomous cars or unmanned aerial vehicles, various service robot systems, smart home appliances such as air-conditioning systems, automatic vacuum cleaners, search and rescue operations, rehabilitation activities and many more.

Even systems that are “fixed” can also act autonomously, take decisions and act in dynamic and cluttered environments as contrasted to being pre-programmed to a fix sequence of actions.

Many of the tasks mentioned above are performed by robots. The fact that our life is becoming more and more “robotized” as well as the possibilities to develop smart systems that may contribute to improve human live, is inspiring more and more students to gain knowledge and become robotics specialists.

Therefore, the main goal of STEM education and technical faculties should be to prepare the students for the forthcoming age. In particular, they should be prepared to:

- understand the principles of working of these devices,
- control and even program such systems in order to use their full potential,
- design and create them, as well as to provide the necessary services for their maintenance.

This is one of the main reasons why robotics education is becoming intrinsic part of the education programs in almost all technical faculties but, also in primary and secondary school. Every application of robotics in any sort of education process is very important if we like to foster the development and permanent growth, and to avoid possible stagnation and gaps.

Following this education mission, at the Faculty of Computer Science at the University Goce Delcev in Stip, the course Fundamentals of Robotics, has been introduced as a part of the bachelor’s curriculum for more than 5 years.

Our previous research showed that students tend to find Robotics very attractive, but they are also aware that it is a multidisciplinary area combining elements of physics, mechanics, electronics, and mathematics.

Our classes are supported by various simulation software programs. This way the students were able to overcome various constraints such as: limited number of physical robots, capability to test and experiment for a limited and fixed number of hours and only during working days etc.

The feedback of our students regarding the simulators was very positive and they found them very useful because they help them to gain better and faster understanding of studied theoretical concepts.

Despite the usefulness of the simulation and virtual laboratories used, the real world tends to be very complex mainly due to the noise and uncertainty of various types. Even through the control of a real robot can be very easy, the behavior of the physical (real) robot depends on the conditions in the real environment. Therefore, including real robots in the education process is very important.

As a result of miniaturization of the hardware components and decrease of the price of electronic components, educational robots are becoming very affordable even for developing economies. The number of educational robots is permanently increased. Different types of educational robots have different appearances, structures (hardware), systems (software), and functions (behavioral outcomes) [14]. These features play an important role in determining the curricula, the instructional activities, and the learning objectives.

Therefore, the main goal of this paper is to present a literature review of the educational robots and their characteristics.

II. CATEGORIES OF EDUCATIONAL ROBOTS

Educational robots can be defined as robotic systems that are supporting the process of teaching and learning. Although educational robots are robots by definition they still differ from the normal perception of state-of-the-art robots that are used in various industrial application.

Various education robots have different features from architectural, structural and functional point of view. In context of educational robotics, hardware components are representing robot body and they are usually classified into three main categories actuators, sensors, effectors. As effector can be considered any device that affects the environment. There are various types of effectors such as legs and arms, wheels, fingers, wings, flippers. The effectors are determined by the tasks the robot should perform, the type of environment in which they should operate etc. Despite everything, usually the effectors are used to move the robot around (locomotion) and to move other objects around (manipulation). Actuators are the actual mechanisms that enable the effector to execute the desired action. Actuators typically include electric motors, hydraulic or pneumatic cylinders, etc. Sensors on the other side are devices used for perceiving the environment and they are necessary in order to make the robots performing the actions autonomously. According to the type of principle of working the sensors can be classified as active or passive and they can serve to sense the internal or external processes and values.

Usually educational robotics have different technical, structural, and functional features, but they share at least one common goal that is education. As educational tools they are made in a specific way with specific materials and level of complexity suitable for laboratory usage. They also have different built-in pedagogical solutions that direct learners to certain actions and which helps them to learn different topics.

The rising popularity of educational robots and their application in all level of studies from primary schools up to university level studies is evident even from the number of scientific articles published (Figure 1).

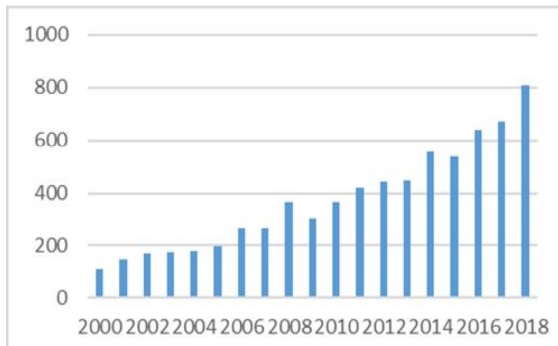

Figure 1. *Total number of articles per year retrieved from Sciencedirect web portal using the following query: "Education* AND Robot*", which retrieves articles that contains any word derived from education and robot words*

Educational robots can be categorized as robotics kits, social robots, and toy robots [15]. Robotics kits are programmable construction kits. Robotics kits allow students to create, build, and/or program robots [15]. Social robots are based on artificial intelligence and autonomous behaviors. Social robots include Socially Interactive Robots (SIR) and Socially Assistive Robots (SAR) [16]. The key feature of social robots is that they can communicate and interact with students [14]. Toy robots are ready-made commercial robots for entertainment and play [17].

III. EDUCATIONAL ROBOTS REVIEW

In this chapter we are analyzing the educational robots that fall into the robotics kits category. Robotics kits are very important because they enable morphological transformations as well as the possibility for extension of the hardware in order to cover various functions and applications. Even more, they also enable functional transformations through software modifications. In this review we have included robotic kits that are applied in at least one curriculum at some university or high school.

Lego Mindstorm [18] is a programmable robotics kit, based on Lego building bricks with special robot parts. The kit includes: servo motors, sensors (ultrasonic, sound, touch, and light), wheels, gears, axes, connection and interface cables, the intelligent brick etc. All this parts are used for the construction of a robots or other automated systems. The intelligent brick is the "brain" of a Mindstorms system, that lets the constructed robot to autonomously perform different operations. LEGO Mindstorms kits are counted among the most widespread tools for teaching robotics and programming.

Boe-Bot [19] is a robot kit that uses a BASIC Stamp 2 programmable microcontroller. Its name (Boe-Bot), comes from the Board of Education carrier board that is mounted on its wheeled chassis. Using this robot kit, students can build several different robots using an engineering style approach.

The MiniSkybot [20] is a mobile robot aimed for educational purposes. The robot is built from 3D-printable parts, and uses a fully open-source mechanics and electronics parts, which can be modified and replaced according to needs. This robotic platform allows the students not only to learn robot programming, but also to modify easily the chassis and create new custom parts. It is also very cheap, since the price is almost exclusively determined by the cost of the servos, electronics and sensors.

VEX robotic platform [21] is designed from the ground up to encourage students' creativity in problem solving. The kit includes microcontroller that acts as the robot "brain", allowing for both autonomous and driver control of robots. The microcontroller also includes wireless communication, enabling remote control with joysticks. The programing part can be done using the VEX coding studio, which is easy to use and easy to learn. Students can learn to program with blocks, transition to text and move into C++ as their skills advance. Users can also test their coding skills with Robot Virtual Worlds, which is a high-end virtual environment.

Fable [22] is a modular construction system that can be used to create different types of robots. Students can assemble modules together in many different configurations. They can build custom robot bodies, use the inbuilt sensors and program the robot's movement. Depending on experience level, students can program using visual blocks (Blockly) or a programming language (Python). While working with Fable students are able to develop comprehensive skills in robotics, programming and innovation.

Alpha Bot2 robot [23] supports Arduino, Raspberry Pi 3 Model B, and Raspberry Pi Zero W, with different adapter boards. It features rich common robot functions including line tracking, obstacle avoiding, Bluetooth/infrared/WiFi remote control, video monitoring, etc. It has a highly integrated modular design, which make it easy to assemble by a snap, no soldering, no wiring. AlphaBot2 employs a 2-layer structure to provide excellent stability and compatibility.

Linorobot [24] is a suite of Open Source ROS compatible robots that aims to provide students, developers, and researchers a low-cost platform in creating new exciting applications on top of ROS (Robot Operating System). Students can use engineering skills to build different robots from the ground-up using easily accessible hardware.

Makeblock Ultimate Robot Kit [25] is a comprehensive robot kit for building complex robots and exploring the robotic world. It contains: metal geared motors, Arduino-compatible controller, programmable RGB LED strip, different kinds of sensors, robotic gripper and other mechanical parts. The constructed robot can be controlled using a smartphone or tablet through Bluetooth connection.

The Speechi robotics sets [26] are carefully thought tools, to learn coding, robotics, electronics, and how those are used in our everyday lives. The sets include: multidirectional building bricks, as well as sensors and actuators (servomotors, buzzer, etc). Different programming interfaces and languages are used, thus allowing a smooth learning curve: icons-based interface, Scratch, Arduino (C, Java), Python, Microsoft MakeCode.

The BIOLOID [27] is an educational robot kit which helps students to learn the basics of structures and principles of robot joints. The name BIOLOID comes from BioAllDroid (Bio + All + Droid = BIOLOID). The BIOLOID platform consists of components and small, modular servomechanisms (AX-12A Dynamixels), which can be used in a daisy-chained fashion to construct robots of various configurations, such as wheeled, legged, or humanoid robots. The Robot is programmed with RoboPlus - C language based software solution.

IV. CONCLUSION

Using robots and robotics in schools and at universities is gaining rising popularity and there is a larger and larger variety of commercial educational robots available in the market. Therefore, the educational robotics emerged as an independent scientific discipline in the last decade. It is defined as a field of study that aims to improve learning experience of people through the creation, implementation, improvement and validation of pedagogical activities, tools (e.g. guidelines and templates) and technologies. In this scientific discipline the educational robots play an active role as pedagogical tools that should facilitate the process of learning and teaching.

Considering the variety of educational robots currently used in the process of education and their constantly increasing number, as well as the permanently increasing number of the articles related to educational robotics published in the last decade or two, in this paper we presented an overview of educational robots. They were described from architectural, structural and functional point of view.

In the context of educational robotics this paper should contribute during the process of preparation of various curricula and planning the hands-on experience part of it.

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Effective Teams for Sustainable Projects– Principles, Practice and Presentation

A. Krstev*, D. Krstev**, B. Krstev***, A. Alili***, B. Nedeva***, K. Todorov***
* Faculty of Computer Science - Goce Delchev University, Stip, Republic of Macedonia
**Faculty of Mechanical Engineering - Saints Cyril and Methodius University, Skopje, R. of Macedonia
***Faculty of Natural and Technical Sciences - Goce Delchev University, Stip, Republic of Macedonia
aleksandar.krstev@ugd.edu.mk, boris.krstev@ugd.edu.mk

Abstract - The supply chain consists of all involved parties, directly or indirectly, in fulfilling the customer's request. The supply chain not only includes the manufacturer and suppliers, but also the logistical activities, carriers, warehouses, stores and customers themselves. Within each organization, the supply chain includes all the functions associated with receiving and filling customer requirements. These functions constitute, but are not limited to, the development of a new product, but also marketing, distribution, finance, and customer service. Global supply chains are evolving into dynamic process networks, in which companies are linked in new combinations based on the context and requirements of individual projects. This dynamic environment requires effective communication, team management and continuous cyclical innovation. The human factor and effective teams in these areas are critical to the effective development of global process networks. The importance of human resources has increased significantly as a result of new places and role in all sectors of society. They are rational, human beings, working with all activities and whose results depend on knowledge, abilities, skills, and motivation. The goal of the paper is to draw attention to the importance of human factors and effective teams in the operation of each enterprise and the necessity of creating a structure of enterprises that will take care of the organizational culture in accordance with the available human resources. This paper also provides an overview of the structure of global supply chain networks and human factors and dimensions that affect their success.

I. INTRODUCTION

It becomes impossible to reject, remove or ignore the sources of turbulence and market volatility. Hence, supply chain managers must accept uncertainty or they need to develop a strategy that allows them to match both supply and demand at an affordable price. Global supply chains are evolving into dynamic process networks in which companies are linked or combined based on the context and requirements of individual projects. This dynamic environment requires effective communication, team and effective management and a steady innovation cycle. Human factors in these areas are critical to the effective development of global process networks. Quality human resources are a key factor for success for any organization, so if the organization wants to reach the top and be a leader, it can no longer depend only on a few outstanding people. Facts and figures are quantitative elements of successful management, but qualitatively, that is, cognitive aspects, are those that can actually make a break or stop at an organization. Assuming that the employees of an organization in some of the supply chains are people with their own mental maps and perceptions, their own goals and personalities and as such they can't be seen as a whole, the HRM believes that the organization should to be able to employ individual and group psychology in order to motivate employees to achieve organizational goals. In a new era of rapid change and a global economy, teamwork dramatically affects the performance of organizations. With the growing need for organization performance, the use of teams becomes one of the most important aspects of the functioning of many companies.

II. EFFECTIVE TEAMS

It is clear that the project manager plays a major role in creating and maintaining an effective team. Maintaining the team is a very important element, because as soon as the team begins to break down or fall behind in the performance of tasks, the manager's job becomes more difficult and he needs to work a lot to get things back to normal. It's much easier to "prevent it than to cure it." If the team is compact and fulfilling, the members will be able to perform the tasks assigned to them and deliver results in a timely manner. The manager has the role to encourage and support the members of the team. As companies restructure, reduce or reduce and / or discover themselves, new roles are created that have aspiration and a tendency to be team-oriented. Organizations become smoother, faster and more agile. The most prominent feature of today's effectiveness is meeting customer needs. Many jobs and projects are becoming more complex, time-less time-bound or burdened, and more global in scope. All these factors collectively allow creation, making and/or increasing efforts and difficulties for one person to perform one job. Modern jobs use teams as a basic work unit (for example, surgical units, airplanes, research and development teams, production teams, etc.).

Although teams are increasingly prevalent in organizations, most of the employees are with related functions or are individualized (for example, by selecting, training, evaluating or interviewing, rewarding, etc.). If there is an incompatibility between the need for the organization to encourage the creation and operation of effective teams and its natural tendency to focus on the individuality of employees, many problems can arise. In addition, some research shows the main reason why some teams fail or that employees are poorly prepared to make a transition from an individual - independent collaborator to a member of the effective team. One of the key factors for developing a higher and effective team execution is to remember that successful teams are not simply created, formatted, done, or fired - choose. Their choice requires a lot of effort and time. Appropriate guidance and support from the team leader should be taken. They seek an organizational culture that enables and fosters teamwork. In order to achieve a high level of team performance, it is necessary for everyone to be familiar with what factors influence team dynamics and effectiveness.

In an attempt to understand how the teams work, a number of authors have suggested models for determining the team's performance. Each of these models is represented by several variables that the author/authors set the effects of the effectiveness of the teams. Some of the models emphasize the group structure and the personal dynamics, while others tend to focus on the talent and motivation of individual team members. Some models have been proposed more than three decades ago, some have been developed in recent years. In an effort to understand how the teams operate or act and work, Michael Lombardo and Robert Eichinger originally developed the T7 model in 1995, presenting key aspects that influence the effectiveness of team work. Based on their reviews and used research literature, they identified five factors inside the team and two factors outside the team that influence the effectiveness of the team. Each one of the factors was named to begin with the letter "T" hence, the name T7 model.

Figure 1. Model T7 for effective teams

The five internal team factors include the following elements: • Thrust - a common goal to be met or a team goal, • Trust - with each other as collaborators, • Talent - collective skills of team members to work, • Teaming Skill - teaming Skills for Effective Performance and Team Efficiency, • Task Skill - successful execution or getting a job.

The two external team factors include the following elements: • Team Leader Fit - to which the team leader meets the needs of team members, • Team Support from the Organization - the extent to which the organization's management allows the team to perform the set or anticipated tasks. Each of the factors inside the team can be drawn into sub-factors or dimensions. In particular, underlining or penetrating consists of the following three dimensions of behavior: (a) undermining or emphasizing management, (b) undermining or emphasizing clarity, and (c) undermining or emphasizing dedication. By contrast, "confidence" includes the following dimensions: (a) trust in the true communication, (b) confidence in actions, and (c) trust in the team. All five internal factors should be present in teams to have high efficiency and effectiveness. However, teams can't be of high performance, except for the necessary organizational and leadership support, which have also been foreseen. It's not as important as a good team for pulling, trusting, talent, pooling skills and/or skills to effect the task, but must have the support of the organization and leadership to train and support it to be effective.

III. Analysis of Effective Teams Using the Pearson Test

The Pearson test, also known as the x2 test, is one of the most non-parametric tests on the basis of contingency. This test is one of the most practical and almost most used tests, and is used in cases where the data obtained from empirical research are expressed in frequencies or can be reduced to frequencies. The test is used when the differences between the group variance of the investigated and theoretical frequencies should be investigated. X2 is sum of quadratic differences of the examined and expected (theoretically set) frequencies placed in relation to the expected frequencies and is calculated according to the formula:

$$x^2 = \frac{\left(f_i - f_i^t\right)^2}{f_i^t}$$

Where: X2 - realized test value; fi - empirical frequencies; fit - theoretical (expected) frequencies i.e. frequencies that you would expect under a certain hypothesis;

The interpretation of the obtained value for x2se based on the theoretical x2 distribution, created by K. Pearson, who calculated and constructed the tables of the limit values of the x2 test for an appropriate number of degrees of freedom and an appropriate probability, i.e. significance threshold. The permissible error (risk) of p = 0.05 and p = 0.01 is the most commonly used threshold of significance. For the purposes of this paper, a probability level of 0.05 and 5% will be used. When the frequencies are arranged in rows and columns, the degrees of freedom (n) are calculated as follows:

$$n = (k-1)(r-1)$$

where: n = degrees of freedom; k = number of columns; r = number of rows;

In this empirical research, the frequencies are divided into two columns and three rows, resulting in 2 degrees of freedom. The default value of x2 for 2 degrees of freedom and significance threshold 0.05 is 5,991, or rounded to 6.0. If the calculated value of x2 is greater than the limit value in the table, which in our case is 5,991 then we conclude that the statements of managers and leaders differ. Otherwise, when the calculated value of x2 is smaller than the table, then the statements of the managers and the leaders do not differ, i.e. they have similar statements, i.e., same thoughts. As we can observe, the x2 - test determines the probability of connection between two variables, not the height of the connection. The amount of connection is obtained by using the coefficient of contingency (C):

$$C = \sqrt{\frac{x^2}{N + x^2}}$$

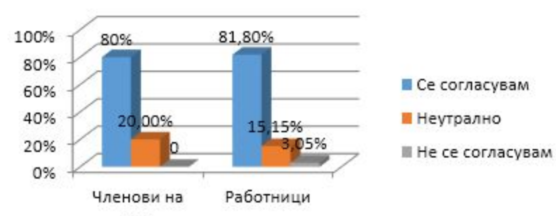
Where: X2 = calculated value for x2, N = total number of frequencies.

The value of the coefficient of contingency ranges from 0 to 1, with how much this coefficient is closer to 1, so the dependent modality of the examined variables is stronger. If the resulting coefficient is closer to 0, then the dependence is not strong. Furthermore, the results obtained from the survey, the calculated calculations for the x2 test and the interpretation of the calculations obtained will be presented. The survey questionnaire covered 67 workers, but fully answered and valid for further processing, there were 66 questionnaires. In the case of team members 15 questionnaires were distributed, out of which 10 were fully answered and valid for further processing. A total of 3 statements were formulated in the questionnaire, and after each of these statements, the employee and team members were randomly selected in the organizations where they were distributed. As previously mentioned, the offered alternatives for each statement are equal: agree, neutral, and disagree.

The first statement is formulated in the following way: 1. The managerial-leadership team is fully committed to achieving the vision, mission, goals and priorities of the organization.

Observed				
Categories	Се согласувам	Неутрално	Не се согласува	Row totals
Членови на тим	8	2	0	10
Работник	54	10	2	66
Column totals	62	12	2	76
Expected				
Categories	Се согласувам	Неутрално	Не се согласува	
Членови на тим	8.157894737	1.578947368	0.263157895	
Работник	53.84210526	10.42105263	1.736842105	
Computing Chi-squared				
Categories	Се согласувам	Неутрално	Не се согласува	
Членови на тим	0.003056027	0.112280702	0.263157895	
Работник	0.000463034	0.017012228	0.039872408	
Sum:	0.435842294			
df:	2			
P-value	0.804188852			

Figure 2. The results obtained in the answers for the first statement are shown in tabular form



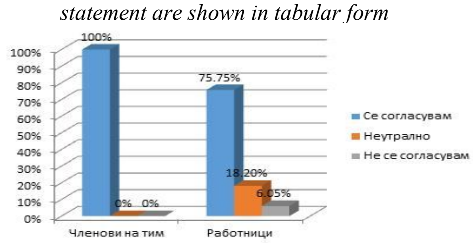
We note that the calculated value for x2 is 0.435 which is less than the x2 table value for 2 degrees of freedom and a probability level of 0.05, which means that the zero hypothesis is accepted and the statements of the employee and team members cannot be concluded they are different.

The second statement is formulated in the following way: 2. The members of the management and leadership team possess knowledge, expertise and experience according to the tasks and responsibilities that they are facing?

We note that the calculated value for x2 is 3.07 which is less than the x2 table value for 2 degrees of freedom and a probability level of 0.05, which means that the zero hypothesis is accepted and the statements of the employee and members of the team does not differ.

Observed				
Categories	Се согласувам	Неутрално	Не се согласува	Row totals
Членови на тим	10	0	0	10
Работник	50	12	4	66
Column totals	60	12	4	76
Expected				
Categories	Се согласувам	Неутрално	Не се согласува	
Членови на тим	7.894736842	1.578947368	0.526315789	
Работник	52.10526316	10.42105263	3.473684211	
Computing Chi-squared				
Categories	Се согласувам	Неутрално	Не се согласува	
Членови на тим	0.561403509	1.578947368	0.526315789	
Работник	0.085061138	0.23923445	0.079744817	
Sum:	3.070707071			
df:	2			
P-value	0.215379533			

Figure 3. The results obtained in the answers for the first statement are shown in tabular form

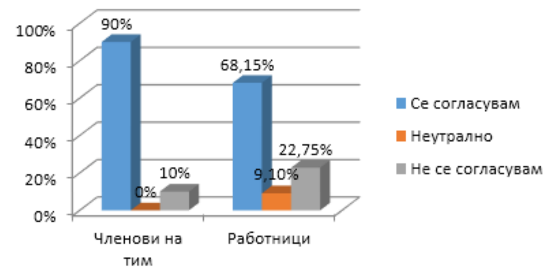


The third statement is formulated in the following way: 3. The communication between the management and leadership team and other employees in the organization is open, sincere, two-way, with a great deal of trust, respect and understanding.

Observed				
Categories	Се согласувам	Неутрално	Не се согласува	Row totals
Членови на тим	9	0	1	10
Работник	45	6	15	66
Column totals	54	6	16	76
Expected				
Categories	Се согласувам	Неутрално	Не се согласува	
Членови на тим	7.105263158	0.789473684	2.105263158	
Работник	46.89473684	5.210526316	13.89473684	
Computing Chi-squared				
Categories	Се согласувам	Неутрално	Не се согласува	
Членови на тим	0.505263158	0.789473684	0.580263158	
Работник	0.076555024	0.119617225	0.08791866	
Sum:	2.159090909			
df:	2			
P-value	0.339749922			

Figure 4. The results obtained in the answers for the first statement are shown in tabular form

We note that the calculated value for x2 is 2.16 which is lower than the x2 table value for 2 degrees of freedom and a probability level of 0.05, which means that the zero hypothesis is accepted and the statements of the employee and members of the team does not differ.



A. Concluding observations from empirical research on effective teams using Pearson test

Because of this, it is necessary to pay more attention to raising awareness among managers about the significance of the team work for the success of the organization as a whole. Group productivity is more important than individual achievement of tasks, and therefore managerial and leadership teams in organizations need to be trained on team work because it dramatically affects the organization's performance. Teamwork is a highly valued work skill in the modern business world. Starting from the fact that the team management model is a modern model of organization of the managerial position, we use this opportunity to give our contribution in this direction, by proposing a model of an effective managerial-leasing team.

This model is created on the basis of the obtained knowledge of the theoretical and empirical research carried out and it is presented in detail in this paper. The possibility for this model to be practiced in the day-to-day operations of organizations in Macedonia gives a bright side to the results of the research. It is obvious that the calculated values for x2 are smaller than the values in the x2 table for 2 degrees of freedom and a probability level of 0.05, which means that the zero hypothesis is acceptable and the statements of the workers and team members can’t be concluded they are different.

IV. CONCLUSION

The new network of strategic imperatives is the transformation of corporate logistics management. In the focus of logistics, managers need to shift from management tools and direct reports to create a new vision of a coordinated product, flow and implementation by influencing the activities of others. Logistics and professionals must learn to exploit the power of human resource management to effect convincing change programs not only in their own companies, but also in other companies in their supply and distribution channels.

Outstandingly, top managers will achieve tremendous strategic and financial gains from coordinating the flow of the product and will emphasize their logistics for new opportunities and the influence of the executive power commensurate with their decisive responsibility. Perceptual logistics managers will realize that making a company - a broad human resources policy is far more difficult than it might seem and they will focus on acquiring this rule. Ultimately, the vision and sense that logistics and professionals will adapt to human resources policies in a company will determine the effectiveness and long-term success of their companies.

The secret to successful teams is very elaborated and emphasized much earlier. In fact, the truth is for them that successful teams are getting stronger when team members learn to work together. They have clear, acceptable goals. Trust among team members and respect for one another. They communicate often and openly. Members have the talent to create and implement ideas. The leader "fits" the needs of the team. Support from human resources departments from the wider part of the organization and the community is strictly foreseen.

The teams have the potential to be one of the most powerful drivers of success in an organization today. However, the effective and high-quality execution of the teams is simply not always happening. It takes time to develop the team and to mature. Adequate managerial measures are being taken to help create the conditions for development and achievement of teams' effectiveness. The T7 model provides a framework that analyzes team work. There should be a full and accurate assessment that will enable systematic gathering of perceptions about the qualities and capabilities of team members, as well as getting the views of other relevant stakeholders. You need to understand how teams work, and then improve teamwork, cohesion and productivity of the team. Talent is not enough! In fact, according to a famous American baseball coach Casey Stengel, or known English coach Sir Alex Ferguson who are fond and used to say: "It is very easy to get good players, but to play together, that's the hard part". The same is true in the business world, and especially in effective teams, where teamwork is a priority.

Empirical research is presented in this paper. The possibility for this model to be practiced in the day-to-day operations of organizations in Macedonia gives a bright side to the results of the research. It is obvious that the calculated values for x2 are smaller than the values in the x2 table for 2 degrees of freedom and a probability level of 0.05, which means that the zero hypothesis is acceptable and the statements of the workers and team members can’t be concluded they are different.

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Modernization of Mathematics Education by Using Educational E-platforms

L. K. Lazarova, M. Miteva, A. Stojanova
University "Goce Delcev", Faculty of computer sciences, Stip, Macedonia
limonka.lazarova@ugd.edu.mk, marija.miteva@ugd.edu.mk, aleksandra.stojanova@ugd.edu.mk

Abstract - Mathematics is not popular subject among students because in the most of cases the teachers use traditional methods and complex approach in the presentation of the content. On the other side, we are living in digital era when the computers and smart phones are included in all spheres in the life. The challenge of the modern educational process is to include the multimedia and interactive materials. The educational e-platforms for studying mathematics are helping teachers and students at the same time. The teachers can analyze the students' success after every lesson and can adapt the materials for their needs, students can communicate with the other students and teacher. However, there is a lack of such materials especially in our and the neighbor countries. The main aim of this paper is to analyze the situation about such educational e-platforms for studying mathematics in Macedonia and neighbored region.

I. INTRODUCTION

Well-known fact is that mathematics is essential subject in the students' educational process, meaning that achieving math knowledge is crucial for correct and easy studying of the other subjects, and more of that, it is crucial for dealing with different everyday situations. However, also well-known fact is that students usually do not find math easy for studying and understanding. The number of students that need help in achieving math knowledge and doing math tasks is significant bigger than the number of talented students and those who can do math without help. We believe that each math teacher makes efforts to introduce math material in a way convenient for the students' age and gives all to contribute in overcoming students' difficulties in the process of learning math. We can face-up with different new methods regarding math-teaching methodology developed in order to improve the above-mentioned situation with the students' attitude toward mathematics. Different papers for presentations and different ways and tools for visualization in the classroom used before the digital era are changing and nowadays we can see different e-technologies in the classrooms, in order students to understand math easily (for example, see [1]). However, the implementation of these e-tools in the process of school learning, in Macedonia and neighborhood is not going so fast.

The development of the technologies nowadays could change the habits of the students and the teachers in the schools. The digital era is emerging so the books and handbooks in the schools could be substitute with new modern materials in electronic form: videos, quizzes, tutorials, interactive tools etc. Can the learning platforms be a started point to do revolution in the education and learning process? Obviously, yes. The learning platforms can change the traditional meaning of the words "study" and "learning". Such e-learning platforms have more consequences that are positive [2]:

- Increased motivation because the e-learning platforms offer more visible and dynamic contents;
- Socialization because the students communicate with other students by using the tools in the e-platform like forums, chats, virtual classrooms.
- Students develop more technological skills, which is essential in these days of digital era.
- Students learn how to manage all the information and time needed for some activities.
- Students learn how to be more responsible and how to estimate their own knowledge by using of the electronic test, quizzes, contextualized problems.

There are many examples of e-platforms for e-learning mathematics in the USA and Europe, but most of them are not open sources. There are some mathematical platforms for e- learning of the specific contents especially in the higher education, [3]. In this paper is concluded that the e-platforms are making mathematical learning more interesting, meaningful and applicable to the learners beyond the classroom knowledge. Also, in [4] is consider the Genie 3 platform. After researching, the authors concluded that the use of such kind of platforms increased the students' engagement and personalization, capturing students' attention, fostering deep learning, and minimizing cognitive load, which leads to improved engagement, and ultimately better educational outcomes.

II. Situation in Macedonia and the Neighbour Countries

Besides all these positive aspects for using of the electronic platforms for e-learning, the situation in Macedonia is not satisfactory. The conducted research in 2011, [5] and [6], shows that there are few e-platforms such [7] which offer e-learning of mathematics, but most of them are not active now. Other e-platforms active at the moment in Macedonia like [8], [9], [10] and [11] offer mathematical lessons in electronic version, tests and lesson plans for the teachers, but they don’t offer videos, tutorials, interactive contents which will enable possibilities for communication, explanation and finding solutions of the problems through debates and forums. In [12] we can see only few videos (about 15 until now, available via the YouTube channel [13]), for certain math problems, with explanations, some of them for secondary school students and the other for university students. These videos cover very little percentage from the math material and problems that students are facing-up. Furthermore, there are no videos for students in primary school. On [14] we can see few video explanations for the problems regarding operations with numbers and power calculations, which is also very little percentage of the math material in primary school. In [15] is shown the impact of the video lectures in increasing the students’ interest in the process of learning mathematics, but there are no available video lectures.

Moodle Platform is used by some universities in Macedonia, but this e-platform has not been made adaptive for primary or secondary schools in Macedonia. It is necessary to find and construct e-platform, which will be in some way substitution of the math teachers when the students are not at schools. This e-platform will enable students to do their homework and projects without asking help from their parents or taking tutoring.

In Serbia the situation about mathematical e-platforms is better than in Macedonia. In [16] it is shown that the level of available e-materials for mathematics education in Serbian language, designed by GeoGebra Centre Belgrade are different and it depends from the age of the students. In Serbia, the level of such materials for kindergartens is low, the materials for primary schools are at satisfying level, but materials for high school, undergraduate and applications of mathematics are large-scaled. The Moodle platform is used in Serbia also at higher levels of the education. There is many e- platforms in Serbia, which are not free for using such [17], some of them offer private classes like [18] and [19]. The most of e-platforms contain only materials such lessons, tests and plans [20], but some of them have video tutorials [21], [22] and [23].

In Croatia, the situation related to the electronic educational platforms is similar as the situation in Serbia and much better than the situation in Macedonia. In the last few years in Croatia has started a project Skole 2.0 which was funded in high percent by the European Union. This project is implemented in collaboration with CARNet together with its partners Samsung, HP, Microsoft. The main goal of this project is to make the classroom in Croatian’ schools as “future classrooms”. That means that the students in a close future can go to the schools without heavy bags full of books and other printed materials. The tablet or computer will be enough to satisfy all their needs, because everything will be in electronic version. The project covers many school subjects, but the teachers have many remarks about not enough innovative approach for mathematical materials.

There are many e-platforms which offer mathematical materials in electronic form for the students in primary and secondary schools and the lesson plans for their teacher, but without videos, forums and quizzes. In [25] which is developed for Android, iOS and Windows and in [26], [27] are presented such kind of materials.

[28] is an educational e-platform for mathematics developed in Croatia in English language aimed to the students in primary schools. This e-platform offers videos and classification of the materials depending of the mathematical area (algebra, geometry) and the grade.

Also, there are many other applications developed in Croatia which are many popular among the students all over the world such as [29], which help the students to solve the mathematical problems when they must do their homework alone, without teacher’s help. But this application is only solver of the mathematical problems. It does not contain more possibilities like the educational platforms. However, it can be concluded that the situation in Croatia is much better than in the other neighbor countries. They have much support of the EU in the part of education, especially for its modernization by including of computers and other digital technologies.

In Slovenia, also there are many educational mathematical platforms. Slovenia like EU member disposes with financial support for this kind of activities. [30], [31], [32], [33], [34] and many others offer videos, instructions, games and tests for students in primary and secondary schools. [35], [36] are only web sites for private lessons and instructions. [37] is Android application with video instructions and exercises in mathematics for young students in primary school. Slovenia disposes with plenty of this kind of educational mathematical platforms for students in primary and secondary schools, but not for the students at the faculty level.

III. MACEDONIAN STUDENTS' NEEDS AND OPINIONS ABOUT EDUCATIONAL PLATFORMS

In order to analyze the real situation in our country, we have proceeded a questionnaire for the students in our University who studied mathematics as a course at the faculty. The questionnaire consists of ten questions, which refer to the use of educational e-platforms in the process of teaching mathematics. 89 students from different faculties (58,4% from Faculty of computer sciences 28,5% from Faculty of technology and 13,1% from Faculty of Educational Sciences) at our University responded the questionnaire. The sample was chosen arbitrary but taking into account that the students at the Faculty of computer sciences studying the most mathematics in their studies, after that the students at the Faculty of technology who studying mathematics in only two subjects in the first year and the students of Faculty of educational sciences who studied mathematics least, only in one subject in the first year of the faculty.

At the first question: How often do you need additional help to explain specific mathematical concepts?, the most of the students 52% said that very often they need additional help for studying mathematics and only 13% said that rarely used additional help after the classes at faculty. That shows that the lectures and exercises at the faculty are not enough for most of the students. Therefore, they need additional tutoring or some other instructions in order to obtain the necessary knowledge to pass the exam and to apply in other sciences. Considering that nowadays we are living in digital era, we appoint the next question: Do you use computer technology for further explanation of mathematical concepts? On that question 40% responded that they use computer technology very often, 36% used it rarely. The next question in the questionnaire was: What do you usually use to get additional explanations for some mathematical concepts? The answers are given on the next pie graph and shows that most of the students do not use electronic platforms. They usually get to use Youtube tutorials where they are watching video instructions and classes and Mathematical forums where can communicate with other students and professors.

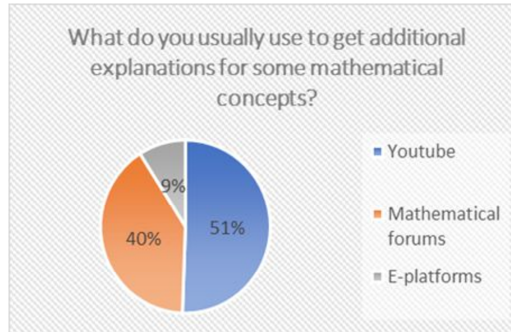

Figure 1. Pie of the answers

For the students, computer tools for geometrical drawings, constructions and graph plotting are unknown. Even 91% do not use the possibilities of these computer tools, which are very helpful during solving of the posted mathematical problems.

Also, they very rarely used online applications to check the acquired mathematical knowledge. Even 82% answered that rarely or never used online tests to assess their mathematical knowledge.

The last two questions in the questionnaire were:

- Do you think that in Macedonia there is a lack of material in Macedonian language in electronic form for studying mathematics?
- Do you think there is a need for creation of an electronic platform that will offer videos, images and texts for better explanation of the mathematical concepts?

The answers are given to the next two pies:

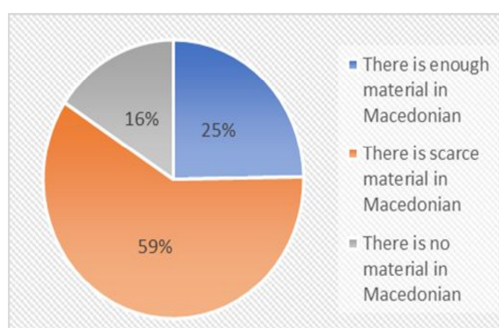

Figure 2: Answers of the question: Do you think that in Macedonia there is a lack of material in Macedonian language in electronic form for studying mathematics?

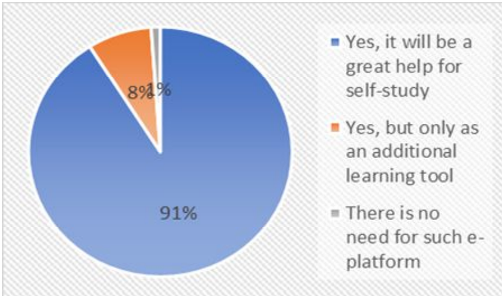

Figure 3: Answers of the question: Do you think there is a need for creation of an electronic platform that will offer videos, images and texts for better explanation of the mathematical concepts?

From graphical presentation in Figure 2 it can be seen that very high percent 75% of the students have answered that there is not enough material in Macedonian for studying mathematics, even 59% percent of them thought that the electronic mathematical material in Macedonian is poor. It is obvious that there is a need of development and preparation of mathematical material in electronic form in their native language. There is a great need to create an electronic platform. Although 91% of the students think that the existence of educational mathematical e-platform will be wonderful help for self-study. 8% said that it will be helpful as an additional tool.

Also, with ANOVA analysis (Table 1) we have concluded that the students' opinion about neediness of educational e-platform not depends of the faculty on which they study. Almost all of them would be grateful if they have possibility to study, discuss and communicate in such e-platform.

TABLE 1. ANOVA RESULTS

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.047	2	0.023	0.572	0.566	3.107
Within Groups	3.352	83	0.040			
Total	3.3983	85				

That shows that development of the educational e-platforms, especially for mathematics is necessary for students' requirements independently of the type of their studies. The specific and complex nature of the mathematics as a science look for such helpful tool for the students, who use the computer and digital technology in their everyday lives. On this way they can study mathematics at their homes after the classes without taking tutoring. The educational e-platforms will contain video tutorials for the students who miss class for some reason. It will contain forums for debates, discussions and finding help for some problems. The quizzes and test will be included for checking of their knowledge. Also, it can be included some tool for geometric illustrations and constructions. In one sentence, the e-platform will be the place where everything which is necessary for studying of some mathematical material will be accessible for every student.

IV. Conclusion

From the conducted analysis it can be concluded that the situation with existence of educational e-platforms at the Balkan, especially in Macedonia is not on high level. The countries which are part of EU have many opportunities for developing of such educational platforms and on that way, they can extend the barriers in the educational process. The worst is the situation in Macedonia. The students have demands for increasing of the computer and mobile use for educational goals. They need such educational e-platforms, not only for mathematics, but for the other subjects because in nowadays when everything is available on internet, the students can study alone, but only if the material is prepared in proper form. The students say they do not have enough material in electronic form and that the existence of an electronic platform for studying mathematics is needed. The possibilities of that kind of platform are huge. Everything that is needed is to include our students at the Faculty of computer science to use their knowledge and to develop such software solution for all students' good. The neighbor countries are excellent examples for that how the things should be appointed.

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The Impact of Teachers Job Satisfaction on the Quality of the Teaching Process in Serbian Primary Schools

I. Tasić*, D. Glušac*,M. Nikolić*, J. Jankov**, M. Ćoćkalo-Hronjec***
*University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
** High school "Mihajlo Pupin", Novi Sad, Republic of Serbia
*** High school "Laza Kostić", Novi Sad, Republic of Serbia
ivatasic@tfzr.uns.ac.rs

Abstract - This paper presents the results of research into the effects of teachers job satisfaction on the teaching process in elementary schools in Serbia. The data was obtained by interviewing N = 362 teachers from 57 primary schools in Serbia. The questionnaires were completed by 250 women and 112 men. According to the results, teacher job satisfaction does affect the quality of the teaching process in primary schools in Serbia. In addition, teacher gender is a moderator of relationships for some dimensions of job satisfaction and dimensions of the teaching process. The moderating influence of teachers' gender has the following direction: job satisfaction, in most cases, has a stronger impact on the teaching process at female teachers than at male teachers in elementary schools in Serbia. The practical significance of the research lies in recognising the current situation and creating conditions that will contribute to greater satisfaction among teachers and lead to improvements in the quality of teaching process in schools.

I. INTRODUCTION

De Nobile and McCormick (2005) consider teachers to be a specific sample of employees because they have different operating conditions and face a high level of stress at their work, compared to employees in companies [1]. Hoerr (2013) emphasizes the importance of job satisfaction of teachers for the success of teaching and the overall atmosphere at school, and that the increase of job satisfaction at teachers comes through learning and advancement of teachers [2]. Therefore, job satisfaction of teachers potentially contributes to the overall school effectiveness. In this way, teachers become more effective and more satisfied. According to Wolk (2008), general pupil satisfaction and general satisfaction in school can hardly be achieved without teachers who are satisfied with their work [3]. Shann (1998) considers that job satisfaction of teachers is an extremely important influence factor on commitment, teacher results and their retention in the profession [4].

The processes of self-evaluation and evaluation of the overall work of the school, and therefore the field of teaching and learning in Serbia started in 2005. The Ministry of Education of the Republic of Serbia, which started this process, found that the main task is to establish, and ensure the quality of work of educational institutions (Bojanić et al., 2005). This implies: responsibility of all actors in the education system, generally accepted and harmonized standards of quality of school work, implementation of standards in practice, mutual trust, school autonomy [5].

Between seven areas that are subject of self-evaluation and evaluation, the Ministry of Education of the Republic of Serbia defined the teaching process and learning as one of the key areas. Through the self-evaluation of teaching and learning, the next indicators are followed: planning and preparing teaching and other forms of educational work, realization of teaching, student activity, learning method, assessment, monitoring, reporting, personal and emotive development of pupils. These indicators, in addition to the school culture indicators, are the starting points of this research. The aim of these measures is the introduction of quality assurance systems based on school self-evaluation and school development planning that would promote the culture of continuous improvement of the educational experience of all young people and children. In this way, the education system of Serbia is approaching to the policy of ensuring quality like in the EU, which basis is self-evaluation. For this purpose, schools were provided with a Handbook for Self-Evaluation and Evaluation of the School's Work, modeled on the Evaluation of Schools Providing Compulsory Education in Europe (Ansdell, 2001). The purpose of this manual is to become the main national reference and practical guide for school administrations and schools in carrying out self-evaluation and school development planning. In European and other countries, the process of self-evaluation, with external evaluation, was accepted as the most effective mechanism for improving the quality of work in school (Bojanić et al., 2005).

II. THEORY AND HYPOTHESIS

A significant number of papers deal with concrete problems related to job satisfaction of teachers. Teachers in China are satisfied if there is support from the school management, student progress and cooperation with colleagues. In the reference (Klassen & Anderson, 2009), examined was a change in job satisfaction of teachers in different periods of time [6]. It was found that the satisfaction with the work of teachers in 2007 was less than in 1962. Nevertheless, regardless of the particular difficulties, the teacher's work brings a lot of satisfaction, which is felt by most teachers (Eisner, 2006). It must be noted here that in Serbia this is often not the case. Reasons are mainly due to a disrupted system of values in the society, poor working conditions and low salaries in education. Research shows that the lack of professional autonomy, enforced accountability procedures, curricular changes, scarce resources, lack of recognition from society and low salaries affect the low level of job satisfaction of teachers in many countries (Dinham & Scott, 1998, 2000, Scott et al., 2001) . In addition, research results show that women are more satisfied with work than male teachers (Hodson, 1989; Bogler, 2002; Lortie, 1975; Ma & MacMillan, 1999; Perrachione et al., 2008) [7] [8] [9] [10] [11].

The results of the research by Dinham and Scott (2000) show that the high level of job satisfaction of teachers is influenced by students successes, close relationships with students, positive relationships with parents and personal improvement, while salaries, vacations and working hours did not have a major impact on satisfaction [12]. Arnett and Polkinghorne (2010) identified factors that contribute to teacher satisfaction and dissatisfaction, taht are: the nature of recent education reforms, the inclusion of pupils with special needs, support and recognition from school administrators, teacher salaries, physical school conditions, daily work in teaching, pupils discipline and behavior, lack of resources and lack of opportunities for career advancement. According to the National Center for Education Statistics (1997), teachers job satisfaction can have a direct impact on the quality of teaching, because when teachers are satisfied with their work, they have a greater motivation to do more that influences the increase in the learning and achievement of students.

In modern pedagogical researches, the concept of the quality of the teaching process is viewed through its conceptual, empirical and normative properties. One of such study was carried out in Australia by Fenstermacher and Richardson (2005) [13]. After analyzing the concept of teaching, which was observed from the aspect of the goal and tasks of teaching, that is, the work of teachers and the real achievement of the pupils. The analysis indicates that good teaching is not the same as successful learning, nor does one logically pull another. A number of other factors beyond the scope of teacher control in the classroom have an influence on the quality teaching process.

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

H1: Job satisfaction has a statistically significant correlation with the teaching process dimensions in primary schools in Serbia.

H2: Job satisfaction has a statistically significant predictive effect on the teaching process dimensions in primary schools in Serbia.

H3: Gender has a moderating effect on the correlation between job satisfaction dimensions and teaching process dimensions in primary schools in Serbia.

III. RESARCH METODOLOGY

A. Survey instruments (measures)

Job satisfaction is measured according to the Job Satisfaction Survey questionnaire (Spector, 1985) [14]. This questionnaire has 36 items related to nine dimensions of job satisfaction. The answers are measured by the six-point Likert scale ranking from 1 (strongly disagree) to 6 (strongly agree).

The measuring instrument for the teaching process is the questionnaire of the Manual for Evaluation and Self-Evaluation of School Work, Ministry of Education and Sports of the Republic of Serbia in cooperation with the British Council Serbia and Montenegro (Bojanić et al., 2005). The answers are measured by the six-point Likert scale ranking from 1 (strongly disagree) to 4 (strongly agree). The names of dimensions of job satisfaction and the dimensions of the teaching process can be found in Table 1.

B. Participants and data collection

The research was carried out in Serbian primary schools. The questionnaires were distributed individually to all teachers in the sampled primary schools. The research was carried out in a way that the respondents (teachers) completed the questionnaire. The questionnaire is composed of items for measuring the dimensions of the job satisfaction and the quality of the teaching process. In addition, the questionnaire also included questions related to general information about respondents, among others, questions about the gender. A total of N = 383 teachers from 57 schools answered the questions. After the initial analysis, due to the significant dispersion of results, 21 questionnaires were rejected. Thus, the total number of respondents was N = 362. The survey included schools from the northern part of Serbia. This area was chosen due to geographical closeness to the authors of the paper.

There were 250 women and 112 men teachers participating. This small sample number of men is the result of employee structure in the Serbian education system (according to gender). According to (Statistical Office of the Republic of Serbia, 2011) in our education system 67% women and 33% men are employed. If we observe primary schools, the percentage of women is even higher than in secondary schools and higher education.

IV. RESULTS

A. Descriptive statistics

Descriptive statistics for job satisfaction and learning process dimensions are shown in Table 1. The values of Cronbach's alpha range from α = 0.703 to α = 0.889.

TABLE 1. DESCRIPTIVE STATISTICS

N=362	Valid N (listwise)	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
Pay	JS1	1.00	6.00	3.071	1.045	.709
Promotion	JS2	1.00	6.00	3.471	1.315	.845
Supervision	JS3	1.00	6.00	4.691	1.143	.870
Fringe benefits	JS4	1.00	6.00	2.954	1.349	.838
Contingent rewards	JS5	1.00	6.00	3.575	1.292	.838
Operating procedures	JS6	1.00	6.00	3.211	1.043	.703
Coworkers	JS7	1.75	6.00	4.598	0.934	.784
Nature of work	JS8	1.50	6.00	5.267	0.849	.855
Communication	JS9	1.00	6.00	4.809	0.950	.827
Planning of classes	TP1	1.00	4.00	3.510	0.446	.815
Preparing classes	TP2	1.57	4.00	3.602	0.399	.889
Communication and cooperation	TP3	2.13	4.00	3.861	0.286	.875
Rationality and organization	TP4	2.25	4.00	3.688	0.354	.856
Encouraging pupils	TP5	2.00	4.00	3.767	0.327	.879
Correlation and application of knowledge	TP6	2.20	4.00	3.638	0.416	.741
Responsibility of pupils	TP7	2.00	4.00	3.631	0.418	.794
The way of learning	TP8	2.29	4.00	3.738	0.355	.854
Monitoring and evaluation	TP9	2.36	4.00	3.772	0.321	.884
Reporting	TP10	1.60	4.00	3.637	0.476	.861
Personal development of pupils	TP11	2.13	4.00	3.720	0.331	.884
Ethical development of pupils	TP12	2.33	4.00	3.640	0.376	.887

B. Correlation analysis

Table 2 shows the results of the correlation analysis: the correlations of the dimensions of job satisfaction and the dimensions of the teaching process. Pirson's correlation was used. In Table 2, statistically significant correlations are indicated in the following way: * p <0.05; ** p <0.01.

TABLE II. CORRELATION ANALYSIS OF JOB SATISFACTION AND TEACHING PROCESS DIMENSIONS

	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10	TP11	TP12
JS1	.310**	.179**	-.001	.100	.119*	.096	.168**	.043	.106*	.181**	.183**	.279**
JS2	.341**	.204**	.048	.141**	.142**	.131*	.137**	.063	.131*	.237**	.231**	.325**
JS3	.357**	.224**	.186**	.201**	.235**	.129*	.197**	.150**	.223**	.279**	.302**	.418**
JS4	.225**	.139**	-.058	.030	.059	.083	.069	-.033	.013	.136**	.116*	.221**
JS5	.342**	.246**	.051	.163**	.150**	.119*	.164**	.092	.133*	.235**	.224**	.358**
JS6	.247**	.078	-.063	.029	.035	.039	.044	-.005	-.012	.066	.087	.197**
JS7	.409**	.322**	.236**	.284**	.255**	.169**	.252**	.206**	.274**	.278**	.281**	.425**
JS8	.413**	.436**	.353**	.384**	.421**	.361**	.318**	.364**	.431**	.366**	.411**	.429**
JS9	.437**	.375**	.281**	.306**	.358**	.218**	.312**	.268**	.365**	.377**	.377**	.494**

C. Regression Analysis

Multiple Regression Analysis was applied to determine the predictive effect of the dimensions of job satisfaction (independent variables) on the teaching process (dependent variables). The results of the regression analysis are shown in Table 3.

TABELA III. MULTIPLE REGRESSION ANALYSIS (DEPENDENT VARIABLE: TP DIMENSIONS; PREDICTORS: JS DIMENSIONS)

Dependent	Independent	β	t	Sig.	R^2	F	F Sig.
TP1	JS1	.102	1.199	.231	.248	12.909	.000
	JS2	.107	1.178	.239			
	JS3	.027	.400	.690			
	JS4	-.089	-1.002	.317			
	JS5	.030	.309	.757			
	JS6	.006	.085	.932			
	JS7	.123	1.710	.088			
	JS8	.205	3.198	.002			
	JS9	.100	1.140	.255			
TP2	JS1	.015	.173	.863	.223	11.239	.000
	JS2	-.022	-.236	.813			
	JS3	-.112	-1.606	.109			
	JS4	.060	.663	.508			
	JS5	.120	1.221	.223			
	JS6	-.144	-2.067	.039			
	JS7	.110	1.503	.134			
	JS8	.336	5.148	.000			
	JS9	.111	1.244	.214			
TP3	JS1	-.020	-.227	.821	.145	7.825	.000
	JS2	.014	.143	.887			
	JS3	.040	.552	.581			
	JS4	-.060	-.636	.525			
	JS5	-.055	-.542	.588			
	JS6	-.145	-2.008	.045			
	JS7	.104	1.374	.170			
	JS8	.250	3.704	.000			
	JS9	.127	1.381	.168			
TP4	JS1	.023	.261	.794	.170	8.009	.000
	JS2	.024	.248	.804			
	JS3	-.042	-.581	.561			
	JS4	-.100	-1.070	.285			
	JS5	.097	.960	.338			
	JS6	-.111	-1.543	.124			
	JS7	.140	1.846	.066			
	JS8	.293	4.343	.000			
	JS9	.036	.389	.697			
TP5	JS1	.041	.470	.638	.198	9.630	.000
	JS2	.015	.159	.874			
	JS3	.006	.080	.937			
	JS4	.016	.174	.862			
	JS5	-.072	-.723	.470			
	JS6	-.107	-1.511	.132			
	JS7	-.018	-.248	.804			
	JS8	.313	4.725	.000			
	JS9	.211	2.339	.020			
TP6	JS1	-.033	-.359	.720	.140	6.381	.000
	JS2	.065	.675	.500			
	JS3	-.086	-1.170	.243			
	JS4	.114	1.189	.235			
	JS5	-.057	-.551	.582			
	JS6	-.056	-.761	.447			
	JS7	-.003	-.043	.966			
	JS8	.403	5.869	.000			
	JS9	.003	.034	.973			
TP7	JS1	.202	2.216	.027	.139	6.299	.000

	JS2	-.047	-.481	.631			
	JS3	-.012	-.168	.867			
	JS4	-.079	-.827	.409			
	JS5	.031	.296	.767			
	JS6	-.156	-2.122	.035			
	JS7	.058	.753	.452			
	JS8	.174	2.529	.012			
	JS9	.163	1.746	.082			
TP8	JS1	.021	.232	.817	.149	6.859	.000
	JS2	-.020	-.209	.834			
	JS3	-.043	-.588	.557			
	JS4	-.117	-1.227	.221			
	JS5	.057	.558	.577			
	JS6	-.063	-.866	.387			
	JS7	.037	.478	.633			
	JS8	.312	4.565	.000			
	JS9	.096	1.029	.304			
TP9	JS1	.101	1.165	.245	.223	11.193	.000
	JS2	.049	.534	.594			
	JS3	-.018	-.258	.797			
	JS4	-.077	-.851	.395			
	JS5	-.052	-.526	.599			
	JS6	-.177	-2.533	.012			
	JS7	.032	.437	.662			
	JS8	.302	4.629	.000			
	JS9	.209	2.351	.019			
TP10	JS1	.051	.571	.569	.183	8.788	.000
	JS2	.114	1.212	.226			
	JS3	.021	.296	.768			
	JS4	.006	.064	.949			
	JS5	-.008	-.079	.937			
	JS6	-.173	-2.420	.016			
	JS7	-.010	-.128	.898			
	JS8	.182	2.728	.007			
	JS9	.238	2.611	.009			
TP11	JS1	.075	.853	.394	.200	9.776	.000
	JS2	.103	1.100	.272			
	JS3	.068	.957	.339			
	JS4	-.047	-.512	.609			
	JS5	-.033	-.333	.739			
	JS6	-.110	-1.556	.121			
	JS7	-.026	-.346	.729			
	JS8	.265	3.995	.000			
	JS9	.167	1.854	.065			
TP12	JS1	.048	.572	.567	.283	15.449	.000
	JS2	.019	.218	.828			
	JS3	.114	1.695	.091			
	JS4	-.024	-.276	.783			
	JS5	.081	.857	.392			
	JS6	-.087	-1.298	.195			
	JS7	.099	1.406	.161			
	JS8	.154	2.451	.015			
	JS9	.206	2.408	.017			

D. Gender as a moderator of the relationships between JS dimensions and TP dimensions

In this part presented are the results of the moderating effects of the respondents gender on the relation between the dimensions of job satisfaction and the dimensions of the teaching process in elementary schools. Correlation analysis was used for the dimensions of job satisfaction and the dimensions of the teaching process, especially for women and men (the results given in Table 4). These results refer to the total sample N = 362 respondents. Pirson's correlation was used. Statistically significant correlations are marked as follows: * p <0.05; ** p <0.01.

TABLE IV. CORRELATION OF DIMENSION JS AND DIMENSIONS TP IN SUB-ASSEMBLIES M (MEN) AND F (WOMEN)

Gender		TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10	TP11	TP12
M	JS1	.238*	.021	.113	.048	.146	-.017	.144	.062	.111	.152	.121	.238*
	JS2	.206	.013	.050	-.022	.049	-.121	.012	-.139	.020	.050	.052	.194
	JS3	.280*	.004	.094	.064	.041	-.116	.138	-.023	.062	.206	.174	.373**
	JS4	.129	-.017	-.019	-.075	-.017	-.133	-.030	-.176	-.057	.003	-.054	.134
	JS5	.264*	.123	.131	.094	.127	-.108	.100	-.072	.119	.135	.077	.299*
	JS6	.132	-.014	.055	-.001	.089	-.081	-.040	-.052	-.031	-.084	-.054	.054
	JS7	.511**	.342**	.417**	.377**	.313**	.202	.345**	.247*	.383**	.399**	.390**	.510**
	JS8	.443**	.334**	.394**	.386**	.396**	.334**	.376**	.332**	.445**	.417**	.501**	.555**
	JS9	.418**	.353**	.356**	.340**	.325**	.204	.344**	.246*	.385**	.434**	.369**	.473**
F	JS1	.350**	.251**	-.044	.123*	.117*	.133*	.184**	.041	.115*	.197**	.209**	.299**
	JS2	.394**	.276**	.042	.189**	.171**	.200**	.170**	.119*	.165**	.288**	.282**	.366**
	JS3	.375**	.286**	.207**	.227**	.286**	.183**	.193**	.185**	.256**	.284**	.327**	.425**
	JS4	.277**	.216**	-.064	.074	.097	.153**	.113	.017	.053	.187**	.176**	.259**
	JS5	.383**	.306**	.024	.191**	.164**	.188**	.191**	.144*	.147*	.271**	.274**	.385**
	JS6	.306**	.129*	-.097	.050	.031	.080	.082	.017	.011	.119*	.137*	.252**
	JS7	.384**	.327**	.174**	.259**	.241**	.160**	.229**	.195**	.247**	.247**	.251**	.405**
	JS8	.384**	.463**	.312**	.364**	.414**	.354**	.271**	.359**	.401**	.327**	.363**	.368**
	JS9	.447**	.387**	.252**	.292**	.370**	.218**	.298**	.271**	.359**	.357**	.376**	.500**

The moderating effect of gender on regression between the dimensions of JS and TP was tested using hierarchical regression analysis. In this way, the significance of the regression coefficient with the product of the predictor variable for the independently variable dimensions of the JS and the dependent variable dimension of the TP and the moderate gender variable was examined, and the results are presented in Table 5.

TABLE V. HIERARCHICAL REGRESSION ANALYSIS WITH GENDER AS A MODERATOR (ONLY PAIRS WHERE A MODERATING INFLUENCE OF GENDER ON THE CORRELATIONS BETWEEN JS DIMENSIONS AND TP DIMENSIONS IS CONFIRMED)

Independent variable	Dependent variable	R square	F-change	Sig. F Change
JS2	TP6	.017	6.279	.013
		.031	5.137	.024
		.048	6.349	.012
	TP8	.004	1.450	.229
		.020	5.899	.016
		.032	4.314	.039
JS3	TP6	.017	6.054	.014
		.028	4.278	.039
		.043	5.495	.020
JS4	TP6	.007	2.519	.113
		.023	5.859	.016
		.037	5.070	.025
JS5	TP6	.014	5.197	.023
		.029	5.599	.018
		.044	5.377	.021
JS7	TP1	.167	72.295	.000
		.188	9.221	.003
		.204	7.100	.008
	TP3	.056	21.260	.000
		.089	12.939	.000
		.120	12.619	.000
	TP9	.075	29.303	.000
		.121	18.724	.000
		.132	4.458	.035
JS8	TP12	.184	81.321	.000
		.188	1.543	.215
		.197	3.925	.048
JS9	TP1	.191	84.986	.000
		.207	7.366	.007
		.234	12.308	.001
	TP3	.079	30.948	.000
		.108	11.664	.001

		.118	3.994	.046
	TP4	.094	37.302	.000
		.112	7.364	.007
		.124	5.017	.026
	TP12	.244	115.939	.000
		.253	4.646	.032
		.266	6.265	.013

V. DISCUSSION

Descriptive statistics (Table 1) show that marks for the quality of teaching process in elementary schools in Serbia are slightly above the average. In this situation, it is useful to consider the lowest average marks. The weakest evaluated dimensions and items are TP1 - Planning of classes and TP2 - Preparing classes. This is logical, given the fact that primary schools are at the center of the educational process, so there is a flexible and broader concept of learning. Within the descriptive statistics, high average marks for job satisfaction dimensions can be noted. The weakest marks gain the dimensions of JS4 - Fringe benefits and JS1 - Pay. This is due to the low living standards and low salaries of employees in elementary schools in Serbia. Among job satisfaction items, the highest average marks have items JS8 - Nature of Work and JS9 - Communication.

Table 2 shows that there are statistically significant correlations of the dimensions of job satisfaction and the dimensions of the teaching process in elementary schools in Serbia. In this way hypothesis H1 was confirmed. From the dimension of the teaching process, the strongest correlation has TP1 – Planing of classes. This is logical, because, if teachers are satisfied with the possibilities to apply different teaching tools and forms of work in order to effectively acquire knowledge and develop pupils' abilities and skills, they will be satisfied with their work. In contrast, from the dimension of the teaching process, the weakest correlation has the dimension TP3 - Communication and cooperation. On this basis, teachers who are satisfied with the possibilities to apply different teaching tools and forms of work in order to effectively acquire knowledge and develop the abilities and skills of pupils will be satisfied with their work. Through the process of teacher education, teachers personal attitude and approach in communication and cooperation with pupils are formed. Consequently, the poor correlation is a consequence of the teacher's personal competences to achieve two-way communication with the pupils and to encourage them to give their observations and as such, they are not under the qualitative influence of the level of job satisfaction.

From the dimensions of job satisfaction, the strongest correlation has JS8 - Nature of work. So, if the teachers are satisfied with the teaching process, they are very likely to be happy with the nature of the work. The lowest average values of all dimensions of job satisfaction have the dimension JS6 - Operating procedures. This is due to an increased volume of work, in particular, administrative tasks that bring decentralization of responsibility to teachers and leads them to a lack of time for direct work with children, which results in less job satisfaction of teachers in Serbia (Pantić et al., 2012).

Table 3 shows the relative high values of the corrected determination indexes R^2, ranging from 0,139 to 0,283. In this way, the predictive effect of leadership on job satisfaction of teachers in primary schools in Serbia has been confirmed. Consequently, the hypothesis H2 is confirmed. Based on the R^2 values, under the greatest impact of job satisfaction, are the following dimensions of the teaching process: TP12 - Ethical development of pupils (R^2 = 0,283) and TP1 - Planning of classes (R^2 = 0,248). This result is consistent with the results of the correlation analysis (Table 2).

Among the results of the regression analysis (Table 3), from the dimensions of job satisfaction Nature of work - JS8 is particularly distinguished. This suggests that increasing the perception of satisfaction with the nature of work is accompanied by the improvement of all aspects of the teaching process. Therefore, in order for teachers to be more engaged in all aspects of the teaching process, they need to understand better what their work responsibilities are and have to be informed about school events. Also, the more teachers think that their work is meaningful and significant, they are more engaged. According to Pantić et al. (2012), the sense of the newspaper in the classroom, which is a legal obligation, is not clear to the teachers, and sometimes it is not even known, which affects the job satisfaction of teachers in Serbia.

The dimension JS1 - Pay is the predictor of the dimensions of the teaching process TP1 - Planning of classes, TP2 – Preparing classes, TP5 - Encouraging pupils, TP9 - Monitoring and evaluation, TP10 - Reporting, TP11 - Personal development of pupils and TP12 - Ethical development of pupils. It can be concluded that, the greater is the satisfaction with salaries, teachers have a more fundamental approach to planning and preparing the lessons. In addition, teachers carefully devise and prepare a teaching curriculum that includes teaching materials from professional literature and from the Internet. Teachers who think they are adequately rewarded for the work they do, prepare materials that are interesting for pupils. They encourage pupils to actively engage themselves, to learn, instruct them to use tehe acquired knowledge, to research and find answers themselves. With the growth of satisfaction, the teacher's objectivity in assessing pupils and monitoring their development increases. The more satisfied teachers are, the better is the reporting, that is, communication between teachers and parents, but also teachers and pupils. In addition, the results show that teachers' commitment is important at developing personal and social attitudes of pupils, which, among other things, involves the engagement of teachers themselves in extracurricular activities. The more satisfied the teachers are, the more they point out to the pupils to be accountable to work and to people, and encourage the cooperation among pupils. They also pay more attention to the ethical development of students, encouraging tolerance, healthy moral values, fairness in interpersonal resuscitations, and more of their efforts to be good examples to pupils, but also to parents and colleagues. The results are in accordance with the results of the research Pantić et al. (2012) about the attitudes of teachers in Serbia, according to which teachers especially emphasize dissatisfaction due to lack of material support. According to teachers' responses, satisfaction with salary is an incentive for engagement in the workplace.

The dimension JS6 - Operating procedures is also distinguished as a significant predictor of the teaching process at TP2 – Preparing classes, TP7 – Responsibility of pupils, TP9 - Monitoring and evaluation and TP10 - Reporting. Therefore, teachers in elementary schools in Serbia who are satisfied with the operational procedures are more willing to cooperate with other members of the expert council. When they consider that their efforts are effective in the workplace and are not blocked nor that there are unnecessary rules and procedures, teachers respect more the specificities of the subject and pupils. Satisfied teachers foster good interpersonal relationships and a positive social climate. By their behavior they give a positive example to pupils and more often praise the positive actions and success of students, encourage them to cooperate and be responsible for their actions. With increased satisfaction with operational procedures, teachers promote tolerance, respect and care for people. Also, they are more engaged in teaching and extracurricular activities. In the research that deals with the attitudes of teachers in Serbia about the profession (Pantić et al., 2012), teachers consider that the increased scope of work, in particular, the administrative tasks assigned to them by the decentralization of responsibilities, leads to a lack of time for direct work with children, which as a result has less job satisfaction of teachers in Serbia.

The dimension JS9 – Communication, has the greatest impact on TP10 - Reporting and TP12 - Ethical development of pupils. According to Pantić et al. (2012), teachers in Serbia believe that a teacher must be a good communicator in relations with parents, colleagues and pupils.

The results shown in Tables 4 and 5 present the existence of a moderate effect of teachers' gender on the observed relationships, and it can be concluded that the hypothesis H3 is confirmed. The moderate influence of teachers' gender has the following direction: job satisfaction has a stronger impact on the teaching process at female teachers than at male teachers in elementary schools in Serbia.

Hierarchical regression analysis (Table 5) has shown that gender is a moderator between the dimensions JS2 - Promotion and the dimension of the teaching process TP6 - Correlation and application of knowledge and TP8 - The way of learning; JS3 - Supervision and TP6 - Correlation and application of knowledge; JS4 - Fringe benefits and TP6 - Correlation and application of knowledge; JS5 - Contingent rewards and TP6 - Correlation and application of knowledge. Therefore, in the teaching process, women teachers have the influence of recognition, praise, gaining greater responsibility, or providing opportunities to achieve something significant. For women teachers, there is a satisfaction with these and similar successes, as well as the feeling that their additional efforts and results of work are adequately rewarded, unlike male teachers.

Hierarchical regression analysis supports the moderating effect of gender on regression between JS7 - Coworkers and TP1 - Planning of classes, TP3 - Communication and cooperation and TP9 - Monitoring and evaluation; JS8 - Nature of work and TP12 - Ethical development of pupils and JS9 - Communication and TP1 - Planning of classes, TP3 - Communication and cooperation, TP4 - Rationality and organization and TP12 - Ethical development of pupils. Male teachers are generally less satisfied with the nature of their work than women. A significant number of studies confirm that women teachers are more satisfied with work in schools than men (Vukonjanski et al., 2014; Ladebo, 2005; Ghazi & Maringe, 2011). This results in male teachers being more sensitive to possible disagreements with colleagues and poor communication. For this reason, satisfaction with the nature of the work, colleagues and communication has a stronger impact on the dimensions of the teaching process at male teachers than at female teachers.

VI. CONCLUSION

The results of the research show that job satisfaction of teachers significantly influences the quality of the teaching process in elementary schools in Serbia. In that sense, in order for teachers to be more engaged in all aspects of the teaching process, they need to understand better what their work responsibilities are and to be informed about school events. In addition, the more teachers think that their work is meaningful and significant, the more are they engaged. Also, job satisfaction is a predictor of the dimensions of the teaching process. The results confirm that teachers gender is the moderator of the relationship between all dimensions of job satisfaction and the dimensions of the teaching process in elementary schools in Serbia. The results of this research show that at women teachers recognition, praising, gaining greater responsibility, or providing opportunities to achieve something significant has an effect on teaching process. On the other hand, it can be concluded that male teachers are generally less satisfied with the nature of the work than women. In such conditions, satisfaction with colleagues and communication additionally influences the teaching process at male teachers, unlike female teachers.

The practical significance of the research is reflected in the recognition of opportunities for improving job satisfaction in order to achieve the desired quality of the teaching process in elementary schools. This can be achieved by organizing appropriate seminars, courses and workshops for school principals in Serbia. Benefits can be very high: by creating quality leadership in schools, it is possible to achieve increased job satisfaction of teachers, and therefore the conditions for better performance of teachers, better results of pupils, and more successful functioning of schools as a whole. Principals in Serbia should be trained to tell teachers the importance and great influence of individual approaches and attitudes of teachers in all segments and aspects of teaching process and pupils development. In addition, they need to be familiar with the differences in job satisfaction at female and male teachers, and in accordance with this knowledge, they should know how to approach employees in order to improve the job satisfaction and teaching process in schools.

A.Limitations and Future Directions

The research limitation is that the results are relevant for primary schools in Serbia. Future research into the impact of job satisfaction on the quality of the teaching process would be interesting to conduct in other countries in the region in order to make a comparison.

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Using of MatLab in the Mathematical Education

A. Stojanova, B. Zlatanovska, M. Kocaleva, D. Rendjova, N. Stojkovikj, D. Bikov
Faculty of computer science, “Goce Delcev” University, Stip, Republic of Macedonia
aleksandra.stojanova@ugd.edu.mk, biljana.zlatanovska@ugd.edu.mk, mirjana.kocaleva@ugd.edu.mk,
dorito.saneva@gmail.com, natasa.maksimova@ugd.edu.mk, dusan.bikov@ugd.edu.mk

Abstract – MATLAB is a multi-paradigm numerical computing environment. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages. In the paper, there is an explanation for solving problems in the field of mathematics, solved in the Matlab programming language. The goal is to show that Matlab is a user-friendly programming language, so it is easy to use. Commands are invoked in a very simple way with a simple syntax, where in comparison with other programming languages; they require detailed knowledge of the language itself.

I. Introduction

Mathematics is an essential discipline that appears in every discipline. The world is rapidly developing technologically and of which mathematics is a required instrument because without mathematics there is no modern society. The traditional educational activity at universities mostly includes lectures and practical lessons. The lecture has been one of the main components of the educational process at the universities for many centuries [1]. The traditional lectures in mathematics usually consist of theoretical material sometimes including practical examples. Usually, the teacher writes the basic information on the board. However, today, technology has become an essential tool for doing mathematics. The use of technology in teaching mathematics has become a popular component of most introductory mathematics classes. It can be used in a variety of ways to improve and enhance the learning of mathematics. Especially, engineering mathematics students are compelled to have access to an appropriate computer technology due to the perpetually increasing complexities of the engineering programs. [2] [3]. Information and communication technology can play an effective role as a cognitive tool in the teaching and learning of mathematics. The use of such technologies can present mathematics in a more authentic and tangible manner. [4] Technology can facilitate mathematical problem solving, communication, reasoning, and proof; moreover, technology can provide students with opportunities to explore different representations of mathematical ideas and support them in making connections both within and outside of mathematics. [5] [6]. Therefore, effective use of technology has the potential to motivate and enliven the learning of mathematics.

MATLAB is one of the most popular programs that is widely used in mathematics classrooms especially at the university level. As more and more universities are adopting its use in education, it is necessary to study and analyze how the software could be used in teaching and learning of mathematics [7] [8].

II. Basis of MATLAB

MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment. A proprietary programming language developed by MathWorks, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, C#, Java, Fortran and Python.

MATLAB is a mathematical and graphical software package. It has numerical, graphical, and programming capabilities. It has built-in functions to do many operations, and there are toolboxes that can be added to augment these functions (e.g., for signal processing). There are versions available for different hardware platforms, and there are both professional and student editions [9].

Although MATLAB is intended primarily for numerical computing, an optional toolbox uses the MuPAD symbolic engine, allowing access to symbolic computing abilities. An additional package, Simulink, adds graphical multi-domain simulation and model-based design for dynamic and embedded systems.

Nowadays, MATLAB has roughly 1 million users across industry and academia. These users come from various backgrounds of engineering, science, and economics.

The MATLAB application is built around the MATLAB scripting language. Common usage of the MATLAB application involves using the Command Window as an interactive mathematical shell or executing text files containing MATLAB code [10].

III. MATLAB COMPUTATION USING SCHOOL EXAMPLES

Variables in Matlab are defined using the assignment operator, =. MATLAB is a weakly typed programming language because types are implicitly converted. It is an inferred typed language because variables can be assigned without declaring their type, except if they are treated as symbolic objects, and then their type can be changed. Values can come from constants, from computation involving values of other variables, or from the output of a function. Matlab can be used for fast calculations.

example: *>> x=[3*4,pi/2]*

x=

12.0000 1.5708

A simple array in Matlab is defined using the colon syntax: initial: increment terminator.

example: *>>1:3:9*

array=

1 4 7

The array starts at 1 (the initial value), increments with each step from the previous value by 3 (the increment value), and stops once if reaches (or to avoid exceeding the terminator value).

The increment value can actually be left out of this syntax (along with one of the colons), to use a default value of 1.

example*: >>ari= 1:4*

ari=

1,2,3,4

An array is named *ari* and includes values 1, 2, 3, 4, since the default value of 1 is used as the incrementer.

Matrices can be defined by separating the elements of a row with blank space or comma and using a semicolon to terminate each row. The list of elements should be surrounded by square brackets: []. Parentheses: () are used to access elements and subarrays (they are also used to denote a function argument list).

example:

>> A = [16 3 2 13; 5 10 11 8; 9 6 7 12; 4 15 14 1]

A =

16 3 2 13

5 10 11 8

9 6 7 12

4 15 14 1

>> A(2,3)

ans =

11

A square identity matrix of size n can be generated using the function eye, and matrices of any size with zeros or ones can be generated with the functions zeros and ones, respectively.

example:

>> eye(3,3)

ans =

1 0 0

0 1 0

0 0 1

>> zeros(2,3)

>> ones(2,3)

ans = *ans =*

0 0 0 *1 1 1*

0 0 0 *1 1 1*

Most MATLAB functions can accept matrices and will apply themselves to each element. For example, mod(2*J,n) will multiply every element in "J" by 2, and then reduce each element modulo "n". MATLAB does include standard "for" and "while" loops, but (as in other similar applications such as R), using the vectorized notation often produces code that is faster to execute. This code, excerpted from the function *magic.m,* creates a magic square M for odd values of n (MATLAB function meshgrid is used here to generate square matrices I and J containing 1:n).

example:

[J,I] = meshgrid(1:n);

A = mod(I + J - (n + 3) / 2, n);

*B = mod(I + 2 * J - 2, n);*

*M = n * A + B + 1;*

MATLAB, also, has structure data types. Since all variables in MATLAB are arrays, a more adequate name is "structure array", where each element of the array has the same field names. Access data in a structure using dot notation of the form *structName.fieldName.* In addition, MATLAB supports dynamic field names (field look-ups by name, field manipulations, etc.). Unfortunately, MATLAB JIT does not support MATLAB structures; therefore, just a simple bundling of various variables into a structure will come at a cost.

When creating a MATLAB function, the name of the file should match the name of the first function in the file. Valid function names begin with an alphabetic character, and can contain letters, numbers, or underscores. Functions are often case sensitive. MATLAB supports elements of lambda calculus by introducing function handles, or function references, which are implemented either in *.m* files or in anonymous-nested functions.

example:

function nanotabl(b) d=load(b);

figure('Position', [100, 300, 600, 460],...

'Name', 'TablePlot',... % Title figure

'NumberTitle', 'off',... % Do not show figure number

'MenuBar', 'none'); % Hide standard menu bar menus

MATLAB supports object-oriented programming including classes, inheritance, virtual dispatch, packages, pass-by-value semantics and pass-by-reference semantics. However, the syntax and calling conventions are significantly different from other. languages. MATLAB has value classes and reference classes, depending on whether the class has handle as a super-class (for reference classes) or not (for value classes).

Method call *behavior* is different between value and reference classes. For example, a call to a method *object.method();* can alter any member of object only if object is an instance of a reference class.

MATLAB supports developing applications with graphical user interface (GUI) features. MATLAB includes GUIDE (GUI development environment) for graphically designing GUIs. It also has tightly integrated graph-plotting features. For example, the function *plot* can be used to produce a graph from two vectors x and y. The code produces the Figure 1, presenting the *sine* function:

Example:

*x = 0:pi/100:2*pi;*

y = sin(x);

plot(x,y)

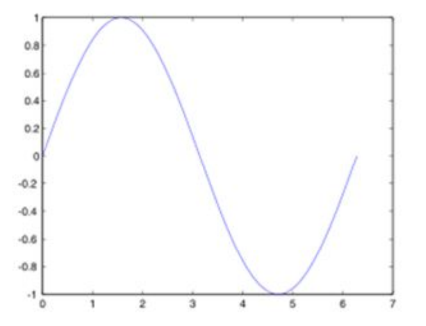

Figure 1. Sine function obtained in Matlab.

A. Solution of the equation: y''+0.05x'+x^3=7.5cos(t) in Matlab.

In mechanical engineering, this equation can model the motion of a forced sinusoidal structure, making great elastic deflections. Here is chosen the parameters in order to see the chaos thanks to the work of Ueda in 1980. Then is turned into a 2 ODE system with

$$y'(t) = y$$

$$y'(t) = 7.5\cos(t) + 0.05x' + x^3$$

We use 2 Matlab .m codes.

*f = @(t,z) [z(2);(7.5*cos(t)-0.05*z(2)-z(1)^3)];*

[t,z]=ode45(f,[0,100],[3,4]);

hold off

figure

plot(t,z(:,1))

hold on

[t,z]=ode45(f,[0,100],[3.01,4.01]);

plot(t,z(:,1),'r')

hold off

figure

[t,z]=ode45(f,[0,100],[3,4]);

plot(z(:,1),z(:,2))

hold on

[t,z]=ode45(f,[0,100],[3.01,4.01]);

```
plot(z(:,1),z(:,2),            'r')
```

We begin with two numerical integrations of the neighboring state, one *x(0)=3,x'=4* This initial state is selected to minimize the initial transitions, since they lie in the region of the phase space that is occupied by the long integration of the previously calculated solution. The waveform effect is quite visible in this example. There is divergence from adjacent starts. Then we plot the x-coordinates (the actual solution *x (t)* to the original 2nd order ODE first for the initial conditions *x(0)=3,x'=4* in blue and then for the initial conditions *x(0)=3.01* and *x'=4.01* in red. (Figure 2 and Figure 3)

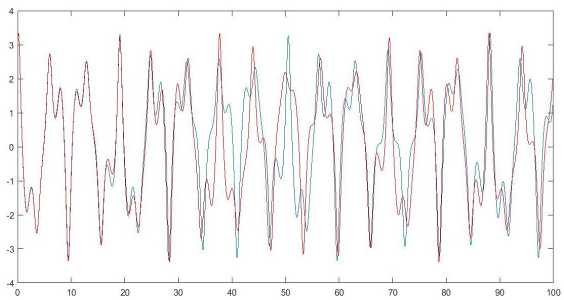

Figure 2. Divergence from adjacent starts: waveforms for Ueda's

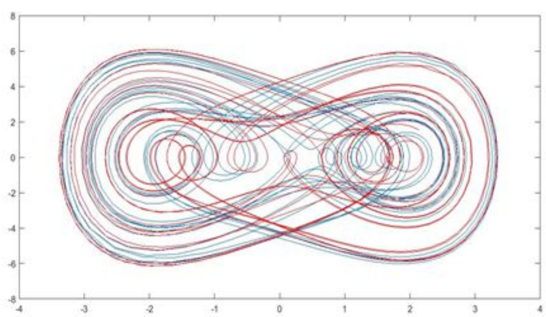

Figure 3. Divergence from adjacent starts: phase projections for Ueda

In the second example (Figure 4 and Figure 5) is shown the starting point (x,y)=(0,0) which presents the initial conditions for

$$x(0) = 0 = x'(0)$$

example

```
clear all
f = @(t,z) [z(2);(7.5*cos(t)-0.05*z(2)-z(1)^3)];
[t,z]=ode45(f,[0,100],[0,0]);
hold off
figure
plot(t,z(:,1))
hold on
[t,z]=ode45(f,[0,100],[0.01,0.01]);
plot(t,z(:,1),'r')
hold off
figure
[t,z]=ode45(f,[0,100],[0,0]);
plot(z(:,1),z(:,2))
hold on
[t,z]=ode45(f,[0,100],[0.01,0.01]);
plot(z(:,1),z(:,2),'r')
```

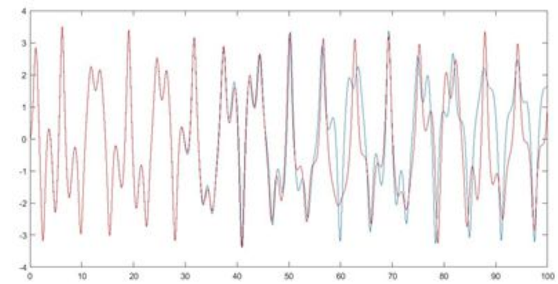

Figure 4. Steady- state of chaos

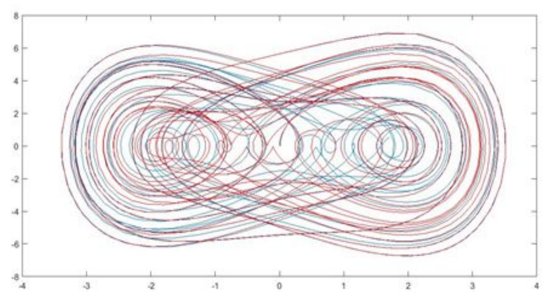

Figure 5. Phase projections for steady- state of chaos

IV. CONCLUSION

The use of technology innovation like Matlab software can improve active involvement of the student in the classroom instruction and enhances their performances. Calculations with Matlab can be performed fast and easily. Matlab software can be integrated in the process of teaching of the various topics such as vectors and matrices as well as plotting graphs of sine, 3D bar, simultaneous and different quadratic equations. Matlab is a very powerful tool for computing, simulations, and powerful software package that has many built in tools for solving problems and developing graphical illustrations. Matlab does not require compiler to execute like C, C++. It just executes each sentence as it is written in code. This increase productivity and coding efficiency. It is higher-level language. Using Matlab Coder the codes written in Matlab can be converted to C++, Java, Python, .Net etc. This makes this language more versatile. So, scientific theories can be implemented in other languages also. Moreover, those library files, or dll s can be directly implemented in other languages.

Matlab has inbuilt rich library of Neural Network, Fuzzy Logic, SImulink, Power System, Hydrolins, Electricsl , Communication, Electromagnetics etc. Thus, developing any scientific simulation is easy to do using such rich library.

Disadvantage is its cost of License. It is very costly and user has to buy each module and pay for it. Disadvantage is during cross compiling or converting Matlab to other language code is very difficult. It is very difficult or requires deep level Matlab knowledge to deal with all errors.

Matlab is not suggested to make any product. Because, Matlab does not create application deployment (installation) like task (like setup files and other executable which copies during installation). Therefore, Matlab is the most suitable for learning mathematics and scientific research. Matlab can be used to improve the understanding difficult topics of Mathematics, especially for students. The experience of using Matlab to support the teaching and learning of mathematics topics may have a strong impact on the learning strategies of students.

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ERASMUS+ Projects as Tool for Improvement Mathematics Teaching

L. K. Lazarova, M. Miteva, T. A. Pachemska
University "Goce Delcev", Faculty of computer sciences, Stip, Republic of Macedonia
limonka.lazarova@ugd.edu.mk, marija.miteva@ugd.edu.mk, tatjana.pacemska@ugd.edu.mk

Abstract - The importance of Mathematics has never been greater than now. To face the challenges of the 21st century each young person needs to have the confidence in using mathematical skills, and Europe needs both specialist mathematicians and a highly numerate population. These skills are crucial for a wide array of analytical, technological, scientific and economic applications. Teaching students to become more adept in mathematics and to appreciate its usefulness is of paramount importance for their future. For that goal, the EU provided financial support for many projects that will help in improvement of the mathematics teaching. In this paper are analyzed and presented some mathematical Erasmus+ projects. They can be used as a tool for bringing innovation and improvement of the teaching process.

I. INTRODUCTION

Mathematics is one of the sciences which is crucial for other sciences' development. During all history, mathematics has greatly contributed for advancement of the other sciences and almost whole technology. The important role of mathematics recognized Cockcroft, for example in [1], he writes: "It would be very difficult, perhaps impossible to live a normal life in very many parts of the world in the twentieth century without making use of mathematics of some kind." The applications of the in a daily activities and situations, its application in other sciences and all spheres of the social life explain the importance of knowing and understanding the basic mathematical concepts. Mathematics has become one of the most important subjects in the school curriculum during this century. As modern societies have increased in complexity and as that complexity has accompanied rapid technological development, so the teaching of mathematics has come under increased scrutiny. So, it is needed to show a special attention to the mathematical education and process of learning mathematics in the schools, [2]. Each student can easily realize that the natural and technical sciences cannot be developed without mathematics.

The mathematics is not popular school subject between students. It can lead to both anxiety in children and teaching difficulties in teachers. Together, these two difficulties can increase the time spent in teaching and learning mathematics. Students' success in mathematics depends upon attitude towards mathematics. Attitude towards mathematics plays a crucial role in the teaching and learning processes of mathematics. Many papers have been done about which factors influence of the students' attitudes towards mathematics. The teaching method, the support of the structure of the school, the family and students' attitude towards school affect the attitudes towards mathematics [3]. 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 [4,5]. Most of the teachers in primary schools used old and traditional methods when they are explaining the basic mathematical concepts. The students are facing up with material that is so many abstract and they could not make correct perceptions. They are boring at the math classes and become indifferent about their achievements and their results in the mathematics. But if teacher uses different methods and relates the mathematical contents with other subject and real situations, the students will show more interest and they would like to include in that kind of activities.

One of the problems facing education in is the problem of the lack of learning process. In the learning process, students are less encouraged to develop the ability to think. Usually in the classroom, the teachers more focused on students' ability to memorize information and methods. The students' brain is forced to remember a variety of information without being required to understand the information that is remembered and constructed into meaningful learning experiences, [6]. Students gained poor mathematical knowledge, have lack of interest for studying mathematics, mathematical incompetence, not like challenges, not doing homework, cheating on the tests. These are only few serious problems in mathematical education. The teachers usually are trying to overcome these problems by using different methods and approaches, but they do not discover the basic problems for such students' behavior. These problems occur due to lack of teachers to recognize, explore, grow and develop mathematical power that exist in students.

The author in [7] consider the situation in mathematics education. He raises the question of whether education in mathematics has become too much comfortable. The author said that is essential the teachers maintain focus on the teaching and learning of mathematics, to flourish in such a competitive research environment. It is also important that the research empowers people, and that the given recommendations and implications improve systems, especially for the disadvantaged. The teachers should provide classes fulfill with fun research. Societies and communities are changing rapidly, which mean that the teachers' work becomes more complex and integrated. In addition, the teachers should simultaneously focus on practice and theory, rather than one or the other. The theoretical frameworks and learning models we develop will need to have the flexibility to be applied in various practice-based contexts. In that context in the last period are realized many projects in order to bring innovations and modern and practical trends in mathematical education.

II. ERASMUS+ PROJECTS AS A TEACHING TOOL

Erasmus+ is the European Union programme for education, training, youth and sport. This action runs for seven years, from 2014 to 2020, with organisations invited to apply for funding each year for life-changing activities. Erasmus+ aims to modernise education, training and youth work across Europe. In the framework of the Erasmus+ programme many projects are realized and some of them are still in progress, which are in the field of mathematical education. The most of them have high percent of innovation in their basis. The main goal of this kind of project is to provide a new methodologies and methods for improvement of the education process. The starting point at almost all of them are obtaining better interest, motivation, knowledge and greater learning outcomes. At the EU level, the Education and Training 2020 strategy underlines the importance of providing efficient and equitable education of high quality in order to improve employability and allow Europe to retain a strong global position. To achieve this objective, continued attention must be paid to raising the level of basic skills such as literacy and numeracy (Council of the European Union, 2009).

According these priorities there are many projects in the field of mathematical education. We will analyze some of them in order to accent the importance of their results and to encourage the teachers and students to used them.

"Who is afraid of Mathematics?", (2017-2019), [8] is a project that have attempt to dismantle math phobia that pervades students in a way that promotes creativity and innovation. This project has made teaching student-centered, active, experiential authentic, collaborative and challenging presenting ways in which mathematical concepts, that children learn, are applicable and related to their daily life. The main objective of this project is to encourage students and teachers to update their knowledge and their skills in using ICT as a means of communication and information exchange as well as to carry and exchange mathematical activities: digital imagery, digital presentations, web logs, project web site, digital video recordings, web conferences and a variety of the web tools.

Maths is everywhere!, [9]. All the participants have made the project innovative because students accessed a more practical and functional aspect of mathematics by creating mathematical games and puzzles, joining in tasks where they can understand the purpose of mathematics and made their own mathematical problems for others to solve. In the framework of the project, many examples related to profit, loss and totaling money are considered. In some tasks the students are involved in creating and solving puzzles, rebuses and they are inspired to create their own games. This enabled their mind to exercise and practice logical thinking.

Smart Mathematics teacher, [10] – One of the main objectives of the project is to enhance math teachers to improve their digital competencies to use mobile applications in the teaching process and to adopt innovative digital practices based on the mobile applications. One of the important results in this project is creation of the E-Directory in which are presented 67 useful applications. These applications can enable math teachers to differentiate and individualize the teaching/learning process according to the students' interests and achievements. With the help of mobile applications, the traditional math lesson is varied with innovative, student friendly and playful learning tools. Teachers are free to choose any mobile application from the list that suits his teaching needs best according to the area of focus: The mobile apps are classified according to the area of focus:

- Numbers and Calculations
- Mixed
- Expressions, equations and inequalities

- Geometry
- Measures and Measurements

MatLan-Learning math and languages through research and cooperation, [11], throughout these project participants have showed that the organizations of workshops can substitute the abstract approach in the classroom with new approach where the students can mathematically investigate issues that no one has answered yet.

Math-Labyrinth: Increasing the level of knowledge through solving mathematical problems, [12], is an Erasmus+ project where as a main result is an interactive book that can be used by teachers and students. The interactive guidebook is divided in two parts including mathematical problems from students in the first, and more complex problems developed by the teachers in the second one. All the areas in this interactive book are related to everyday situations and according to the syllabuses of the national examinations. It is developed to enhance the brain's ability to visualize and transform knowledge into a solution to a real-life problem.

MathDebate - The voice of students - searching excellence in math education through increasing the motivation for learning, [13] is a project in which are developed a new MathDebate method, e-platform with included e-forum and tutorial for using of this platform. The goal of this platform that is source of videos, presentations is to offer a possibility of the students to choose on which method they want to study some material. They debate for the method with the other students from the class and after that teacher present some teaching unit, by using of the chosen method.

The project "Math-GAMES - games and mathematics in education for adults – compendiums, Guidelines and courses for numeracy learning methods based on games", [14], is a project that is realized in order to save traditional and famous games in different countries from a loss and to use them for educational purposes. In the framework of this project are created learning courses for using traditional games with normal and lower-skilled people fighting numeracy. In the project is provided a list of different traditional transnational games (photos, game instructions), which can provide social integration. As traditional games are taken board games, card games, role-plays, acts, folk games involving dramatics, e.g. but not computer games. This is an excellent opportunity for teacher in mathematics to use the obtained project' result and to include games at the mathematical classes. LeMath - Learning mathematics through new communication factors, [15]. Generally, it is known that mathematics is a subject that is not popular among the students. The students usually find other things that are more interesting, instead solving tasks and learning mathematics. For this purpose, teachers should try to use, but for educational purposes, the same things or similar tools as electronic games, game through theatre or competitions, that are favored to students. In this project is created a new methodology in teaching and learning mathematics, with the creation of two main tools that can be used by teachers. The two methods are MATHeatre: Teaching and learning mathematics through math theatre activities and MATHFactor: Teaching and learning mathematics through mathematics communication activities. It is provided theatre scenarios- stories with math elements and guidelines and MATHFactor samples and guidelines.

There are many other similar Erasmus+ educational projects that offer many useful results, which can be used not only in mathematics but in the education process of other sciences.

III. Conclusion

The projects have important and useful results that can be included in the education process. The developed approaches and methodologies should be tested and applied not only in the schools that are partners and doers of them, but also in the other schools and educational organizations. All the results of this kind of projects are available to the internet for all users, teachers and students, so everyone can use them. Actually, the obtained results in these projects are used in the first five years after the project is finished, but after that, nobody cares about these results. Today when the knowledge is easily available, the teachers are forced to have innovative approach and to make many changes in the teaching process. Because of the lack of students' interest and high innovation in computer and digital technology, the teacher must get over the traditional approach with new modern and fun approach in which will include the mobile phones, computers, and tablets. The obtained results of the Erasmus+ project are excellent opportunity and source for new ideas, methodologies, methods and approaches. The teachers should use and find appropriate way to include these results into the teaching process and to announce all these possibilities to the students in order to show that mathematics can be studied in a different and more interesting way. Students should meet with new approaches and to understand that mathematics is present in everyday situations and different fields. The students should learn that some things that at first sight seem to have no connection with mathematics, such as music, sports, art, theater can be linked to mathematics and its basic concepts. It will be very useful if all these results of the projects that are applicable in education process will be put on one website as additional educational tools for teachers and students.

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Using the Internet for Students’ Self Education

N. Bobinac, A. Cakić, V. Makitan
University of Novi Sad, Technical Faculty “Mihajlo Pupin”, Zrenjanin, Republic of Serbia
nikolabobinac@gmail.com, aleksa.cakic@gmail.com, vesna@tfzr.uns.ac.rs

Abstract – In the digital age, when it is hard for modern organizations, companies, institutions and educational system especially, to adopt the newest technologies as they appear, self education is becoming more and more popular. This paper analyses the students’ activities of a real-life study program course project and demonstrates how self education by using the internet could be useful for everyone enrolled into formal education system to advance their knowledge beyond the coursework area. Different motivational factors that affect on self education success are presented in the paper. Also, the paper tackles the amount of freedom that professor gives to student in order to motivate his/her work when assigning them on tasks or projects.

I. Introduction

The technology development nowadays has the speed that can be rarely aligned with its application in modern organizations, companies or institutions. The education system is not an exception and has the long way of adopting the newest technologies. The problem appears and after that, because the new technologies included into the study programs may become outdated after the first generation of the students finish the studies. For those reasons it is important for students to realize the importance of their self education, i.e. the education beside one they gain in formal education system institutions.

There are many definitions on self education, and many contexts in which it appears. Internet sources defines self education as “the act or process of educating oneself by one's own efforts especially through reading and informal study [1]”, or as “gaining knowledge and insight for the sake of one’s own benefit [2]”, etc. It is defined and discussed in many other sources [3-6], and according to one of its first definitions [7] self educations is “the extent to which in the teaching-learning relationship, it is the learner rather than the teacher who determines the goals, the learning procedures and resources, and the evaluation decisions of the learning program”.

In this paper it would be paid attention on self education in the context of personnel training and professional development. Modern learner “should be able to integrate knowledge from different sources, educate and self-educate throughout the life in order to be competitive in an increasingly globalized labor market”. [8]

The internet can be a useful tool for students eager to expand their knowledge beyond the study programs and subject curricula. On the other hand, this does not mean that knowledge gained through self education cannot be applied within their study program courses projects.

Importance of motivation for self education of students is recognized as well and presented in this paper. Because of the long procedure in study programs changes, motivation for additional research and studying of students is necessary.

In order to present the possibilities of student’s self education, its motivation and outcome, the real life student’s project is analyzed in this paper. It was a particular study program course project – information technology project, realized by the students without complete prior knowledge necessary for its realization. Students themselves set up milestones, defined activities and personal expectations, which is also described in this paper. Everything is the result of above-mentioned project and experience that students had along its realization.

II. Motivation for Self Education

One of the most important factors of students' self education is possibility to expand their knowledge. During the course project it is recognized that both, the professor and the student have their role in motivation in the following ways:

1. *The professor*
    - When assigning the students a course project, the professor should give the students as much freedom as the course allows: in choosing the project topic and technologies that may be used;
    - The minimum project requirements should cover the course topics, but also other areas that are not covered with the course program;
    - The professor should make flexible schedule in project presentations by allowing the students to set their own

deadlines, in accordance with the course program.

2. *The student*
   - When choosing the project topic students may use following guidelines: choose something that is their passion, use something that is their own hobby or special interest and avoid textbook example topics. Also, a student should choose a subject with which he is familiar and has prior knowledge about it, without fear of lack of experience at the beginning of the project;
   - When setting a deadline, the student should choose between the latest and the nearest one. The first case may increase the probability of prolongation that leads to less hands-on work on the project. On the other hand, choosing an early deadline may increase the probability of unexpected issues and disable the student to finish the project in determined time.

By including the previous guidelines student will be motivated to do the project, and to go even further: to explore outside of the scope of the subject in order to expand his/her knowledge.

Beside meeting the minimum criteria, it is recommended that the student should strive at least one step beyond the requirements set. On the other hand, it is sufficient that the student satisfies only the minimum criteria, since it is sometimes difficult to find motivation for self education. In order to improve teaching methods and discover other motivation factors, the professor should explore students work and presentations in more details.

III. Taking on the Project

The project which is the subject of this paper is part of the course "On-line Media Basics" and has three possible outcomes: Blog website, E-Magazine and Video log. Propositions were: work in pairs or individual, free choice of topic, date of project presentation and software platform that will be used for on-line edition development. It was recommended that students use one application for development of an e-magazine, or a blog or a video log.

In the case of the project described in this paper, both the professor and the students who worked on the project, followed the previously described motivation factors. It is important to note that after setting the propositions, students set their own goals and defined the project activities to be achieved in order to get desired output. In this case, it was far more than required.

At the very beginning, students (authors of this paper) with similar interests joined together and, decided to create video log, regardless of their minor video editing experience.

1. *Choosing a topic*

In case of choosing a topic for a video project, it was easily agreed that it would be a video trailer for a students' hobby: a Role-playing tabletop game called *Dungeons & Dragons*. This has been students' hobby for over a year, and they have been interested in role-playing games even longer. Without the need to further educate themselves about the chosen topic, students made decision to do a video for the story of the game. The final version of the topic was "Video trailer for a Role-playing game" and it was approved by the professor. Choosing the topic that was familiar to students enabled them to devote more to the project itself.

2. *Setting the deadline*

The students agreed to give themselves a four week deadline for the project completion. In their opinion it was quite enough time to complete the project and to accomplish everything they had in mind to be completed.

IV. Choosing a Software Platform

Before working on the project and based on their experience so far, students determined which software could be used. At best, about all software available to students they had only amateur knowledge. Considering that, they have not given up on choosing these software, in order to improve their knowledge.

Students listed following software that is necessary for project realization:

- Adobe Premiere Pro, Adobe After Effects, Adobe Photoshop – solutions by the USA company Adobe [9] for multimedia content design editing and creation;
- Unity 3D Game Engine – real-time development platform [10];
- Audacity – free software for sound editing [11].

1. *Students' previous knowledge*

One student who is the part of the project team had previous knowledge in: video editing in Adobe

Premiere Pro, video manipulation in Adobe After Effects, photo manipulation in Adobe Photoshop and developing 2D games in Unity 3D Game Engine. All of the software was previously used by the student in spare time as a hobby.

The other student had previous knowledge in: video editing in Adobe Premiere Pro and video manipulation in Adobe After Effects, as well as photo manipulation and logo design in Adobe Photoshop. By doing some freelancing in the past, this student had a bit more experience than the first one. They also needed a software for sound manipulation in order to do a voice-over for the video and the other student decided to learn how to use free software Audacity for this purpose. On the other hand, the first student decided to learn how to export 3D models from other sources, because they wanted to build a scene for the video in Unity 3D game engine.

The students agreed that they could use all the software listed above for their project, with Adobe After Effects being the main software used because of the abundance of effects it had.

After deciding on the software, the students agreed to use royalty-free assets for their project.

V. THE PROJECT

The project lasted four weeks during the semester and had over 70 working hours of both students. This work was divided into the following sections: planning, resource scouting, self education and working on the scenes in the software.

1. Planning

Planning included deciding on how the final product should look like, splitting the video trailer into scenes and allocating who is best suited for particular part of the project.

2. Recource scouting

During the resource scouting students were looking for royalty-free music, sound assets, images, models and fonts that are available for non-commercial use and may be included into the project scenes.

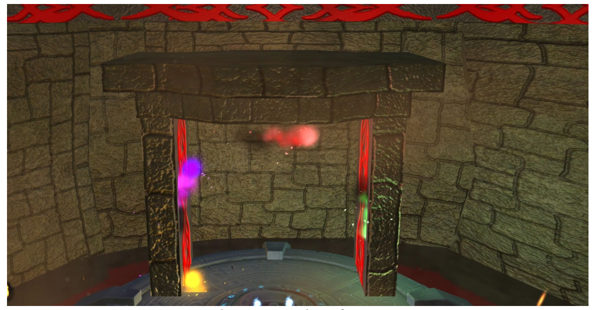

Figure 1. The example of project scenes

3. Self education

Students had to gain additional knowledge in order to achieve their goal, i.e. to create a video trailer. This included progress from an amateur to an intermediate level in software usage. Majority of time spent on self education included learning about specific software features, exploring them individually, watching video tutorials and reading from forum posts.

4. Working on the scenes in software

Each scene required usage of one or more software. The majority of the scenes were done in Adobe After Effects, alongside Adobe Photoshop and Unity 3D Game Engine for some scenes (Figure 2.). The voice-over was recorded and edited in Audacity and DarkAudacity. After that it was combined with the video in Adobe Premier Pro in order to create the final product.

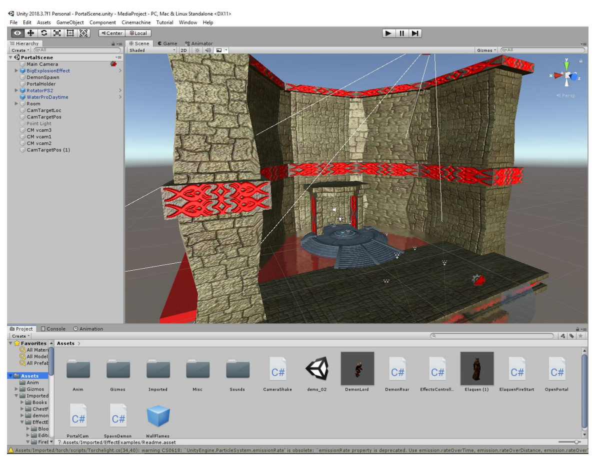

Figure 2. The example of working on the scenes in software

It was hard to make an estimation on task duration since they were intertwined. Students were searching for resources and tutorials and at the same time they worked in the software. The plans were changed throughout the project. Certain part of the work in the software was not related to the project itself, but necessary for testing of what was learned and investigation in order to use it in the project.

Figure 3. represents time distribution during the project realization. It can be seen that the majority of time was not spent on planning or working on the scenes, but on self education. This is partly because the students were passionate about the topic they had chosen and had an amateur level of previous knowledge about the technologies they used. The essence of the project was to improve their knowledge about these technologies through the acquisition of practical experience in these areas.

At the end of the project, both students have expanded their knowledge about the selected technologies, in following order:

- The first student gained intermediate level of knowledge about the Adobe After Effects video manipulation and effect generation (Introduction scene [12]), Adobe Photoshop design for themed images (Map scene [12]) and logo design (Introduction scene [12]), Adobe Premiere Pro for vide transitions [12] and post processing color correction [13] and Unity 3D Game Engine for creating and scripting 3D scenes;
- The second student has improved his knowledge about Adobe After Effects creation of animated scenes from scratch (Fireside scene [12]), Adobe Photoshop for partials lighting before exporting to other software and Audacity for voice manipulation.

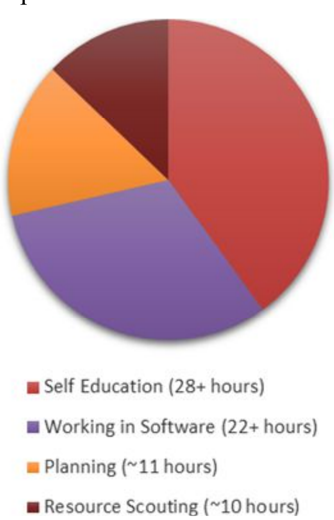

Figure 3. Time distribution during the project realization

Both students noted improvement in general knowledge about video editing in Adobe Premiere Pro, gained practical experience in planning and working on video projects, and gained insight into team work.

Figure 4. The project intro

Among the software that the students selected for their project only one was studied within the study program offered by the faculty. This means that most of the necessary knowledge for creating the final product [12] came from the students themselves, who were motivated enough and inspired to learn more than required. Figure 4 represents the introduction image of the trailer for the game.

VI. CONCLUSION

By giving more freedom to students on certain subjects, both student and faculty can benefit from motivating self-education. Students receive a wider range of knowledge about the technologies they are interested in, and the faculty as an outcome has students who know how to find a motive for achieving goals that are above the required. From a student perspective, the key part is that both the students and the professors are “on the same page”, and willing to learn more than it is required from them. If the student is properly motivated and interested in a course projects the self-education process could bring him/her more opportunities in the future. In addition to the recognized motivational factors described in this paper, important role in self education has the character of the students themselves, the working habits they have and the ways they choose to achieve required objectives. This is recognized from the professors’ perspective.

As a result of this research, the students who participated in the project felt more motivated to start freelancing in areas where they acquired knowledge. It was in areas of video editing, photo manipulation, logo design, game design and sound manipulation. Also, factors that can influence on motivation of students for self education are identified. This may contribute to enriching teaching content and improving teaching methods.

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[12] https://youtu.be/YrjQIqStEkA Revenants - The Rise of Baphomet (D&D Story Arc Trailer) – Final product of the project

[13] https://youtu.be/jftUFRVU334 Final Product Color Compariso

The Impact of Leadership on the Develompent of Education

N. Petrović*, E. Terek*, D. Sajfert**, V. Premčevski*, T. Petković ***
*University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
**College Dositej, Bulevar vojvode Pitnika 7, Belgrade, Republic of Serbia
*** Higher agricultural school of vocational studies, Šabac, Republic of Serbia
petrovic.n26@gmail.com

Abstract - The authors in this paper represent the influence and importance of leadership on the development of education. Leadership is the principle of managing a modern organization. The role of leadership is aimed at providing a better flow of knowledge in educational institutions. Leaders are required to possess knowledge and skills, the ability to innovate and manage. Leadership in institutions of education aims to represent the process of planning, organizing, managing and controlling financial, physical, human and information resources, in achieving better quality goals, in an efficient and effective way of doing business. Education represents the core of every society educational, cultural chain that constantly vibrates. In such a chain, in addition to educators, teachers, professors and others, the leading role should be an educated, capable and skilled leader. Further work will discuss the theoretical approach of leaders to the development of education.

I. INTRODUCTION

Leaders, managers of educational institutions and organizations must understand and manage the phases of work and institution development, coherence, norms and conflicts in the goal establish an effective team. Certainly, it should be noted that team work does not come by itself, but depends on the skills of communication and leadership of all members. Because, effective teams in educational institutions are striving to: improving the performance of the collective, increasing the cooperation and morale of employees, improving interpersonal relationships in the educational institution, reducing conflicts, all with the goal of achieving mutual success [5].

School leaders improve educational achievements of students through a strong impact on teacher motivation and working conditions in their schools [11]. A managerial position in an organization is demanding, requiring an ability to make an impact on people, to make things happen and to lead subordinates. For a leader, one of the most challenging situations in their career might be entering an organization as a newcomer. Previous studies suggest that these situations and the adaptation and learning required of the new leader are demanding, and unfortunately new leaders quite often fail to meet the challenge [6]. These situations can be devastating for the leader, both in personal and career terms, and moreover, the failures can adversely affect the organization [21], [6]. Leadership implies an approach to people mamagement in an organization based on one person's influence on another person independetly of the formal right to realize that influence [15]. Without influence, leadership does not exist [19]. Knowledge can be unavailable or hidden, which means that the wheel is constantly being reinvented [20].

II. THE IMPACT OF LEADERSHIP ON EDUCATION

The basic foundation of each state is the education of young people. Until the implementation of successful socio-economic development comes with knowledge, and the knowledge comes from the education of young people. This creates a number of questions that seek answers in the educational development process that receives the attributes of one of the supporting factors of the country's development. Therefore, changes require activities within the educational process, that is, everything that the education system can make more efficient and effective in the context of socio-economic development of Serbia [16]. Successful development requires adequate knowledge, inventiveness, responsibility, initiative and innovation, and a lot of work. Also, new market realities require elasticity and speed [22]. The digital age gave people new ways of communication and interaction [14].

For a new leader, the first year on a post is the most crucial; moreover, the formation of interpersonal relationships is the single thing that most determines the success of the new leader. For a new leader, the key element in successful managerial succession is building interpersonal links with the organization [6]. Interpersonal relationships help the newcomer learn about the organization and the workgroup, the role that is expected of them, the necessary skills and knowledge and will guide them on how to act in the new position [9], [6].

The concept of leadership does not imply uniformity, recipe, but the skill of leading and helping those who learn to use and develop their own potentials, motives and emotions in new values creation, in their attitude towards changes, creation of preconditions for reaching maximum results in personal and environmental development. Contemporary and innovative school prefers such an organizational culture and concept of (self) development and (self) education, is new concept of school leadership is especially challenging for the education in Serbia as a developing country, currently in the process of reforming and transforming education, democratization and decentralization [10].

Among them, the impact of the style of managerial leadership plays an important role [13]. A leader should have knowledge of effective communication techniques and the ability to create situations and activities that provide opportunities for their application Leadership is often defined in organizational theory literature as an influential process that guides the behavior of individuals and groups towards the achievement of goals A number of authors have dealt with the influence of leadership styles on job performance, organizational commitment and satisfaction. Remarked that it would be useful to know what impact personal characteristics such as age have on leadership practices which are theoretically based on some suggested principles [2].

Leadership should create a leadership culture in the organization and drive the process of learning through challenges [8]. For leaders in education, it is necessary to demonstrate an understanding of the moral complexity and the ability to create clear links between values and actions undertaken in educational institutions. The leader in education is trying to establish conditions for dialogue, participation and respect for people and their ideas [3].

The ideal leader in education, among other things, should be:

- Integrator of personnel potentials and work processes,
- The entrepreneur and producer of successful educational results,
- A systematic initiator of ideas, actions and changes,
- A creative visionary and planner,
- Communication coordinator,
- Constructive technology organization and innovation,
- Participant animator,
- Strategies through continuous education, etc. [5].

Education policy is an important part of the overall development policy of a society, in which business entities should be key drivers of innovation, competitiveness and improvement of modern education system [16]. The development of science and technology affect the growth of the volume of scientific and social information that is directly relevant to individuals [12]. The need to invest in the development of education, or the creation and improvement of appropriate human resources, in response to certain market economy needs, has the character of the investment and becoming a prerequisite without which people cannot achieve sustainable economic development of society and its progress.

Leadership is typically defined as a process of deliberate influence that results in achieving the desired goals [17]. Many authors point to the need to differentiate between leadership and management. While management is focused on maintaining functionality and efficiency, leadership is based on vision, change and value [24]. It can be said that these are two interconnected roles that are practically impossible to separate.

Leadership is seen as a key organizational correlate [23], as well as school performance [18]. Claim that, after quality teaching, leadership is the most important predictor of student achievement. Previous research has shown that the leadership of school principals influences various elements of its functioning, including the attitudes of teachers and the academic achievement of students [7]. There is evidence that successful directors have an impact on increasing the time spent by students in learning, as much as two to seven months during the school year [4]. Leadership is significant within a school factor that affects the socio-emotional competencies of students and teachers [23].

The results of international comparative student achievement studies (PISA) show that those countries in which schools have greater autonomy in decision making are more successful. Raising the level of autonomy of schools requires the development of appropriate competencies of leaders in education. Therefore, in countries with high-quality school systems development director in education generally required [23].

III. CONCLUSIONS

The role of the modern concept of education should have directed straight towards the acquisition of practical knowledge and skill requirements, accepted in all spheres of life. The need for educational institutions for the engagement of educated and professional managers raises the level of organization and improves the performance of the institution, which includes the satisfaction of all stakeholders and users of the services of the education process of young people [16].

Full implementation of management in the education system introduced international best practice for the management of educational institutions and its processes, improve the working conditions in the institution, achieved growth of competency management institutions and organizations, solve everyday problems, the image of the institution and motivation of employees, the satisfaction of students, students and parents is achieved, all of which have a significant impact on the socio-economic development of society as a whole. It is important for the organizations to deal with social responsibility, regardless of social or economic circumstances [25].

The future of Serbian education and science primarily depends on those who work in education and who sincerely want to preserve and improve it according to the national and state interests of development [22]. The future is what is now in development. Working with young people is still at the beginning of what is yet to be [1].

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Short Programs of Higher Education Studies in the Republic of Serbia

M. Kovačević*, I. Tasić**, S. Kovalevskyy***, O. Kovalevska***
* Technical College of Applied Sciences in Zrenjanin, Zrenjanin, Republic of Serbia
**University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
***Donabass State Engineering Academy (DSEA), Kramatorsk, Ukraine
miodrag.kovacevic@vts-zr.edu.rs

Abstract - Activities of higher education in the Republic of Serbia is realized through academic and vocational studies based on accredited study programs for acquiring higher education. Academic courses are conducted academic study programs that enable students to develop and apply scientific, artistic and professional achievements. For vocational studies are carried out vocational study programs, students are able to apply and develop professional knowledge and skills necessary to participate in the working process. We want professional training of persons with acquired secondary and higher education for inclusion in the work process, performed a short program of study which should have a clearly defined structure, purpose and learning outcomes, and which is issued a certificate of completion of a short program of study and acquired competences. The aim of the introduction of short programs of study in the educational system of the Republic of Serbia is that in a short period of time enabling effective and efficient education and training experts for a particular job based on the expressed needs of specific employers. A short program of study by type, level and scope of knowledge and skills that students are trained correspond to higher education, are short programs of study. Each accredited institution of higher education in the Republic of Serbia can bring and run short programs of study only if they have the support of employers, it is necessary to document the agreement of the expressed needs, declaration of employers about the positive evaluation of the proposal the curriculum short program of study and / or declaration of readiness at least one employer that if their employees to enroll in the short program of study or if after further testing and selection, employ persons who have received a certificate of completion of a short program of study. Student who has passed all the exams and passed the verification of the acquired knowledge and skills, which has successfully acquired the intended learning outcomes, an institution of higher education institutions in the Republic of Serbia shall issue a certificate of completion of a short program of study. This document is a confirmation that the student has trained and qualified to perform a specific job and that has the appropriate competence. Form certificate is unique and prescribed by the minister responsible for higher education. With the certificate is issued and the addition of a certificate stating: list of items (and for student, with associated ECTS and the given grade), knowledge and skills as well as learning outcomes (acquired by the student, that are relevant to the job for which issuing the certificate)

I. INTRODUCTION

The education system in the Republic of Serbia of this school year will be given the opportunity to educate and improve the first professionals who have completed short courses of study, for a period of 3 to 18 months. The National Council for Higher Education of the Republic of Serbia has adopted the organization, implementation and issuance of certificates for short programs of study, but its entry into force was postponed for May 2019. Based issued the Regulations on the organization, implementation, certification and procedure of keeping records for short study programs of higher education institutions in the Republic of Serbia will be able to organize, prepare and perform a short program of study for which it is necessary to previously submit to the National Council for Higher Education for the issue compliance. The Law on Higher Education of the Republic of Serbia has provided short study programs, in order to more efficiently connect higher education and the labor market. Higher education institutions that implement short study programs have an obligation to this short study programs accredited. A short program of studies can enroll anyone who has completed four years of high school or a higher level of education and wants to specialize in one. It is possible that the short study programei enroll and those with college or university degrees if they want development in their own or another compatible education. When working on a short study programs retpostavlja that the greatest intesovanje be short study programs in IT sector. Rules on the organization, implementation, issuing the certificate, and the method of keeping records for short training programs it is envisaged that the short programs are organized in a study of the volume of 300 - 600 hours of active classes and can vary from 3 to 18 months. The student eventually acquires a certificate with a description of the job for which it is qualified and competencies. The aim of the introduction of short programs in the educational system of the Republic of Serbia is that in the short term enable effective and efficient education and training of professionals for a specific job, which by Niové competencies and complexity corresponds to higher education, based on the expressed needs of the employer.

II. REGISTRATION AND PROCEDURE OF SHORT STUDY PROGRAM

Higher education institution be organized and implemented independently or in cooperation with other institutions of higher education short programs of study. Higher education institutions must have the status of legal entity and licensed ministry in charge of higher education. Common short study programs are realized in the seats of higher education institutions, with precisely defined parts of short study programs that are implemented in the individual seats of higher education institutions. The authorities of higher education institutions adopt a document on the implementation of the common short study program (hereinafter referred to as document), in which all the elements are defined to guarantee the fulfillment of the appropriate standards for carrying out the common short program studies within academia. An integral part of the documents and decisions of the professional bodies of higher education institutions on the adoption of the document (teaching and research or teaching professional higher). The basic elements of the contents of the document are: Details of the short program of study appropriate standards for the performance of common short program of study and specificity.

Specifics include:

a) Hiring of personnel, material and physical resources of each institution of higher education in particular;
b) Obligations of each higher education institution in the process of performing a short program of study and
c) Sources of funding and a way of covering costs.

Certificate of completion of a short program of study shall be signed by authorized persons of the higher education institutions participating in the short program of study in the case of a joint certificate or persons authorized to sign a double certificate of completion of a short program of study.

Accredited higher education institutions jointly organized a short program of study jointly submitted to the National Council for Higher Education documents prescribed by the Ordinance on the organization, implementation, certification and record keeping procedure for short study programs ("Official Gazette" of the RS, no. 32/19).

Higher education institution may organize and conduct several short study programs if there is interest in higher education institutions and the needs of employers and interested participants. Based on the proposal of the managing bodies of the higher education institution or a group of members of the professional body (scientific and teaching or teaching-professional council) Professional body of higher education institution, in accordance with its Rules of Procedure shall decide on the procedure for registering, organizing and conducting a short study programs.

To create a curriculum, the content of short programs of study objectives and defining competencies and registration program higher education institution may establish a special working group. The working group can engage and experts who are not employed in a higher education institution.

A short study programs not subject to the accreditation process, which is prescribed for study programs.

Higher education institution should have this activity have stated in their Constitution and must have adequate acts which more closely regulates the preparation, adoption and implementation of short programs of study. In the context of an ordinary or extraordinary external quality checks, the Commission for Accreditation and control this type of activity brings a higher education institution and the appropriate corrective measures, if it determines the existence of irregularities. All acts of the higher education institutions, including those relating to the regulation of short realization of the program of study must be in accordance with the regulations governing higher education.

Depending on the educational mission, scope and nature of the knowledge and skills to ensure students (person who attended a short program of study) and the complexity of the job for which he prepared a short program of study can be organized within the academic type higher education first, second and third degree or professional type of higher education first and second degree.

III. ORGANIZATION AND STRUCTURE OF PROCESSES OF SHORT STUDY PROGRAM

A short study program is organized in the scope of the teaching process of 300 to 600 classes per (30 - 60 ECTS), can last from three to 18 months, and ensures acquisition of the appropriate certificate. For the organization of short study programs the general rules adopted for higher education and to: load trainee during the working week of up to 40 hours of which 20 - 30 hours of contact teaching.

Active teaching includes lectures and practical exercises to the extent of 20 - 30 classes (or integrated classes and classes) per week and an additional practice / job training to the extent of 10 - 30% of the active teaching. The teaching program to the short study is carried out independently from the instruction at the academic and vocational studies. A short program of studies is generally compliant with the requirements of the labor market. The higher education institution may adopt and carry out a short program of study only if it has the support of employers as documented agreement of the expressed needs, declaration of employers about the positive evaluation of the proposal the curriculum and / or declaration of readiness bar an employer that its employees to enroll in the short program of study or, after further testing and selection, employ persons who have received a certificate of completion of a short program of study.A short program of study may issue and implement an accredited institution of scientific, artistic or technical fields in which he has at least one accredited degree program.

Classes on short study programs can be organized in three ways:

a) classic in the premises of higher education institutions in which she performs accredited study programs;
b) as well as distance learning and
c) by combining these two methods.

Implementation of teaching on short study programs as a rule, the higher education institution organized and carried out at the premises, in which copies and accredited study programs. Realization of educational activities and programming related to the implementation of vocational training institution of higher education can be realized in the premises of employers, public services and so on. For the purposes of implementation of practical work of teaching, or practice / training that is carried out higher education institutions, higher education institutions can choose the title of associate outside employment (Associate Practitioner) a person employed in the institution where part of practical training, or practice / training is implemented. The higher education institution in its acts specify the conditions to be met by practitioners to be involved in the implementation of short programs of study as well as teachers and staff outside employment: eg. Higher Education in the first degree, published professional or artistic work / achievements in the relevant field, work experience in which students are trained in the ability of pedagogy and the like. A higher education institution may contract of engagement or contract on additional work to engage teachers, aides and tutors who have the necessary competences (knowledge and skills) and the reference in the field of art to which the engagement. Number of teachers involved in teaching the short program of study meets the needs of the program depends on the number of cases and the number of hours of theoretical and practical training. A higher education institution may contract of engagement or contract on additional work to engage teachers, aides and tutors who have the necessary competences (knowledge and skills) and the reference in the field of art to which the engagement. Number of teachers involved in teaching the short program of study meets the needs of the program depends on the number of cases and the number of hours of theoretical and practical training. A higher education institution may contract of engagement or contract on additional work to engage teachers, aides and tutors who have the necessary competences (knowledge and skills) and the reference in the field of art to which the engagement. Number of teachers involved in teaching the short program of study meets the needs of the program depends on the number of cases and the number of hours of theoretical and practical training.

Engagement of teacher on a short program of study can't be higher than the average of 12 classes per week. Only teachers who are permanently employed in institutions of higher education teachers may be responsible for a specific subject in the curriculum of short programs of study. Number of staff involved in teaching in the short program of study meets the needs of the study program and depends on the number of cases and the number of hours of practical training. Involvement by associate a short program of study can't be higher than the average of 16 classes per week. For teaching higher education institution may hire experts who are not employed in a higher education institution. In this case the institution finds appropriate type of contract according to the Regulations on the procedure for acquiring the title and the employment of teachers and staff of the higher education institution.

The higher education institution in its acts determines the conditions, manner and procedure for appointment of teaching basis that they met the conditions for conducting practical training or work practice / training for the implementation of short programs of study. The mutual rights and obligations of the higher education institution and teaching base can be regulated by an agreement by which it prepares and delivers a short program of study.

IV. DETERMINATION OF SCHOLARSHIPS FOR STUDY PARTICIPANTS SHORT PROGRAM

Council of higher education institution, on a proposal from the professional body (scientific and teaching or teaching-professional council) decides on the amount of compensation paid by the persons who attend a short program of study.The criteria for determining the tuition fees are determined by the Rulebook on the criteria for determining fees and the provision of higher education institutions. The higher education institution shall before publishing applications for enrollment determines the amount of tuition for a short program of study. Tuition includes educational services for the whole short program of studies and compensation for regular services to the higher education institution provides students with a short program of study. The criteria for determining the decision on the amount of tuition fees should be made publicly available on the official website of the university. The tuition fee for a short program of study, as a rule, be borne by the participants themselves or employers who have enrolled their employees in the short program of study. Distribution of the implementation of the proceeds of the program are carried out by a short in accordance with the general acts HEI and special agreements embodiment, short program study

V. RIGHTS AND OBLIGATIONS OF PARTICIPANTS SHORT PROGRAM OF STUDY

The rights and obligations of participants are regulated by the individual agreement concluded between higher education institutions, students and employers that their employees enrolled in the short program of study.

The student has the right to:

1. quality education and objective assessment of knowledge;

2. timely and accurate information on all issues related to the short program of study;

3. The self-organization and the right to express their views;

4. The same study conditions that apply to all students;

5. diversity and freedom from discrimination.

The student is required to:

1. sign the contract on attendance short program of study;

2. respects the general regulations of the higher education institution;

3. respect the rights of employees and other participants and students in higher education institutions;

4. participate in decision making in accordance with the law.

The student has the right to appeal in accordance with the Statute of the higher education institution if the institution breached an obligation of the executive officer of higher education institution, which is obliged to resolve any complaint within three (3) days. Teaching schedule is published on the notice board and website of the higher education institution in a timely manner before the beginning of the short program of study. In justified cases, during the implementation of short programs of study institution may amend the schedule of classes. Ranking persons registered for the short program of studies done on the basis of the success achieved during the secondary school or the last level of education, according to which a short program of study the student enrolled.

VI. RECORD KEEPING ON SHORT STUDY PROGRAM

Student who has passed all the exams and passed the verification of the acquired knowledge and skills, ie. which has successfully achieved the intended learning outcomes, higher education institution shall issue a certificate of completion of a short program of study. This document is a confirmation that the student has trained and qualified to perform a specific job. Form certificate is unique and prescribed by the minister responsible for higher education.

In addition to the certificate states:

1) a list of items that the student has passed, with associated ECTS and the given grade;

2) knowledge and skills as well as learning outcomes, acquired by the student, that are relevant to the job for which the certificate is issued;

3) a description of the job for which the certificate holder is qualified.

The higher education institution is obliged to keep records on the realized short courses of study and certificates issued in accordance with the law governing higher education, supporting regulations governing higher education and the implementation of short programs of study. Student service higher education institutions keep and permanently stores the complete documentation of individual records with short programs of study for each student individually.

At the end of each school year, based on data collected from the Student Services is preparing a report on short study programs implemented during the school year at a higher education institution. The report contains the names of realized short program of study, the number of participants and all the elements required by the regulations governing higher education. The report adopted by the professional body of a higher education institution (teaching and scientific or educational-vocational higher). The report shall be submitted to the National Council for Higher Education.

Records are kept in written form, and can be conducted electronically. About the registered persons in the short program of studies higher education institution shall keep separate records.

For registration of candidates to the program of basic academic or vocational studies can be carried out recognition of ECTS credits acquired within a short program of study.

At the request of the person who has completed a short program of study and who were enrolled in the first year of the study program of basic academic or professional studies, higher education institutions may recognize objects / parts of the course that the student has passed under the short program of study, depending on the degree of overlap with the subjects enrolled studying program. About the completed recognition of higher education institutions adopt a special decision on the recognition of the explanation, in accordance with the act, which more closely regulates the preparation, adoption and implementation of short programs of study, which lists the objects / parts of the objects that are placed within a short program of study and the corresponding number ECTS which can be recognized in the enrolled study program. Recognition of ECTS is done on the basis of the Study on equivalence,

If the registered person in the short program of study to waive or do not attend more than two / thirds of the teaching, be deemed to have given up on attending the program further, with what remains an obligation of settling financial obligations under the contract concluded with the higher education institution.

VII. CONCLUSION

For training professional training of persons with acquired secondary and higher education and for their easier and efficient involvement in work processes, organized and carried out a short study programs, which should have a clearly defined structure, purpose and outcomes of learning and practical training which is issued a certificate of complete a short program of study and acquired competences to work in the respective areas to the national qualifications framework of the Republic of Serbia. The aim of the introduction of short programs of study in higher education system of the Republic of Serbia is that in a short period of time enabling effective and efficient education and training experts for a particular job based on the expressed needs of specific employers.

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Accessing Students According to their Type of Personality Regarding Big Five

M. Kavalić*, S. Vlačić **, M. Ćoćkalo Hronjec***, S. Stanisavljev*, N. Ljubojev*
* University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
** University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Republic of Serbia
***High school "Laza Kostić", Novi Sad, Republic of Serbia
mila@tfzr.uns.ac.rs

Abstract – The aim of this work is to represent results of the pilot research carried out on the group of students, Engineering management profile. The objective was to comprehend their personality type according to Big Five theory. The problem of the research shows how the young should be educated, how they can overcome and correct their negative action and improve their positive one through personality analysis. The general idea is to develop positive attitude towards themselves and other people as well.

I. INTRODUCTION

In contemporary psychology, the Big Five traits of personality are five broad domains which define human personality and account for individual differences.

Human resources professionals often use the Big Five personality dimensions to help place employees. In education, professors and assistants take the role of HR managers so it is crucial that they estimate their students well and develop the relevant approach based on their personality type. This approach would result in improving students' positive characteristics and correcting the negative ones.

That is because these dimensions are considered to be the underlying traits that make up an individual's overall personality.

The Big Five personality traits are:

- Openness
- Conscientiousness
- Extraversion
- Agreeableness
- Neuroticism

II. THEORETICAL FRAMEWORK

Several independent sets of researchers discovered and defined the five broad traits based on empirical, data-driven research. Ernest Tupes and Raymond Christal advanced the initial model, based on work done at the U.S. Air Force Personnel Laboratory in the late 1950s [1].

J.M. Digman proposed his five factor model of personality in 19902, and Goldberg extended it to the highest level of organizations in 1993 [2]. In a personality test, the Five Factor Model or FFM4 and the Global Factors of personality may also be used to reference the Big Five traits [3].

Most results relating traits to social company and behavioral contexts can be interpreted from the perspective of trait-consistency, that is, people may prefer to be in situations that provide opportunities for expressing their traits [4][5].

For instance, extraversion is positively associated with spending more time in social contexts [6][7]. Extraversion is negatively related to being alone, positively related to spending time in conversation [8], and positively related to spending time with various companies such as friends, colleagues, and strangers [9].

Agreeableness is positively related to reporting being with friends. Emotional stability (reverse neuroticism) is negatively related to how much time people spend being alone, doing chores, and watching TV [9].

Conscientiousness is positively related to spending more time in class [8], engaging in non-leisurely pursuits [10], and working [9]. Finally, openness is positively related to being around strangers and negatively related to being with family, watching TV, or doing "nothing" [9]. One limitation of these studies, is that they relied on self-reports, with the exception of [8]. Thus, they were not able to distinguish between objective contexts and subjective construal of context [11].

There is some evidence that personality and contextual factors interact to predict affective experience. Experimental studies have shown that extraversion is positively related to EA (but not pleasant affect) more strongly in goal-oriented, rewarding situations [12][13]. This finding and has received initial support in a study of affect in natural environments [14]. Neuroticism is related more strongly to negative affect in stressful situations [15] [16] [17]. The results indicate that, after controlling for risky behaviors, school attachment, and low self-control, neuroticism is positively related to victimization [18].

There is also preliminary evidence that extraversion, conscientiousness, and openness may buffer the effects of stress on daily negative affect [16].

According to S. Buecker (2019) the Big Five dimensions of personality are related to loneliness. Extraversion (r = -.370), agreeableness (r = -.243), conscientiousness (r = -.202), and openness (r = -.107) were negatively related to loneliness. Neuroticism was positively related to loneliness (r = .358). Several loneliness-personality-associations were moderated by age, loneliness type, and the loneliness scale used [19].

Prior research shows that personality traits predict time spent with different people and frequency of engagement in different activities. Further, personality traits, company, and activity are related to the experience of affect. However, little research has examined personality, context, and affect together in the same study. In the current study, 78 people described their Big. Participants indicated their current company, activity, and momentary affect along the dimensions of energetic arousal (EA), tense arousal (TA), and hedonic tone (HT) [20].

III. METHODOLOGY

A. The Subject and the Problem of Research

The subject of this research is the estimation of students' personality type based on Big Five theory. The problem shows how to educate young people in order to overcome their negative action and improve the positive one. The general aim is to develop a positive attitude both towards themselves and the others as well.

B. Research Goals

The goal of the research is to represent results of the pilot research carried out on the group of students, Engineering management profile. Also, the goal is to comprehend an adequate personality type according to Big Five theory which will result in finding an adequate model regarding accessing students and improving their productivity.

C. Research Question

Research questions are:

1) How many examinees are extravert/introvert?
2) How many examinees belong to open type personality?
3) How many examinees belong to cooperative personality type?
4) How many examinees belong to conscientious personality type?
5) How many examinees suffer from neuroticism?

D. Research Method

Research method is based on carrying out the reserarch on the group of students, Engineering managemet profile. (N=21). The research in the form of a questionnaire was carried out during February 2019. Big Five questionnaire was used. It was made to present 5 dimensions or 5 big personality types. Each dimension includes 5 items, 35 items in total. Linkert scale from 1 to 7 was used, where 5 is minimum and 35 maximum. Therefore, 5 categories representing one dimension were used for presenting the results.

IV. RESULTS AND DISCUSSION

Research results are presented through these 5 dimensions. Each dimension was measured on the sample (students) and then their personality type and and the extent of representation were shown. An estimation of their current psychological state was observed.

Extraversion - Extraverts get their energy from interacting with others, while introverts get their energy from within themselves. Extraversion includes the traits of energetic, talkative, and assertive. The results of this dimension are in the Figure 1 (Figure 1.). On the grounds of the results it can be concluded that majority of students are extraverts (RQ1.). Extraverts are social, assertive, active, communicative and extremely optimistic persons. It is positive that all students are extraverts.

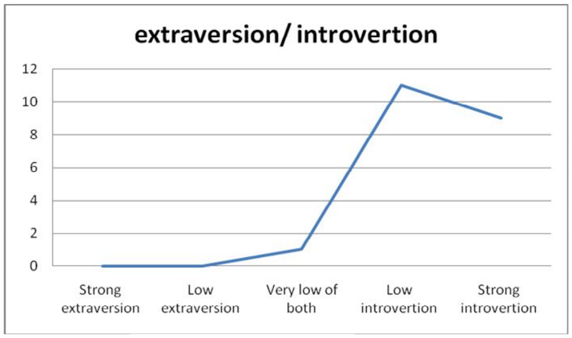

Figure 1. Dimension extraversion

Openness - People who like to learn new things and enjoy new experiences usually score high in openness. Openness includes traits like being insightful and imaginative and having a wide variety of interests. Presentation of the results regarding this dimension can be seen in Figure 2 (Figure 2.). Based on the results it can be concluded that majority of students belong to open personality type which was expected because of extraversion dimension results (RQ 2.).

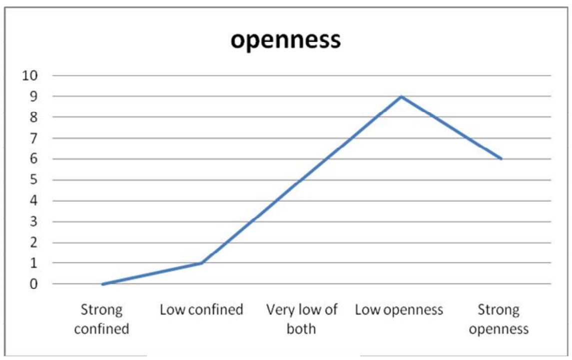

Figure 2. Dimension openness

Agreeableness - These individuals are friendly, cooperative, and compassionate. People with low agreeableness may be more distant. Traits include being kind, affectionate, and sympathetic. The results of this dimension are in Figure 3 (Figure 3.). Based on the results it can be concluded that majority of students belong to agreeableness personality type, the curve is rising which tells us that all students are agreeable (RQ 3.).

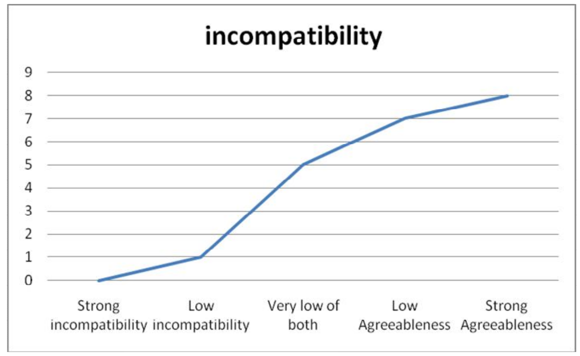

Figure 3. Dimension agreeableness

Conscientiousness - People that have a high degree of conscientiousness are reliable and prompt. Traits include being organized, methodic, and thorough. These results are shown in Figure 4 (Figure 4.). According to the results it can be concluded that all students were estimated as conscientious. There wasn't anyone who was estimated as unconscientious, and most students were very conscientious (RQ 4.).

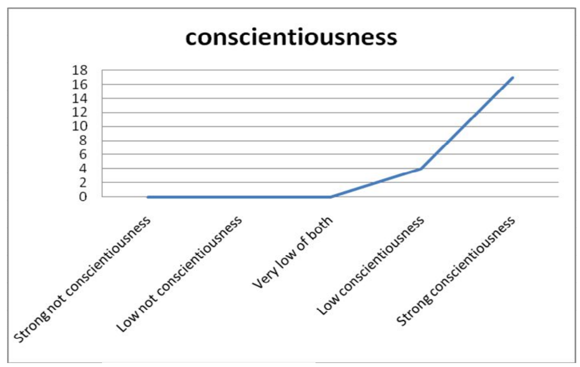

Figure 4. Dimension conscientiousness

Neuroticism - Neuroticism is also sometimes called Emotional Stability. This dimension relates to one's emotional stability and degree of negative emotions. People that score high on neuroticism often experience emotional instability and negative emotions. Traits include being moody and tense. Males and females with neuroticism are prone to irational ideas, they have difficulties in contolling impulses and weak capacity for overcoming stress. Those with slightly less expressed neuroticism can be seen as emotionally stable, relaxed, calm and they are able to face stressful situations without panicking. This dimension is presented in Figure 5. (Figure 5.). According to the results, it can be concluded that majority of students were estimated as personality types without neuroticism traits and emotional instability (RQ 5). Emotional instability can be improved with age and personal work, so these results were expected in the sample consisting of young population. Students often face various challeges without precisely defined aims, therefore uncertainty is permanent.

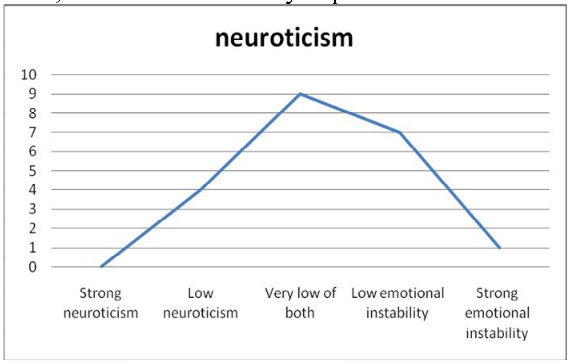

Figure 5. Dimension neuroticism

V. CONCLUSION

Observing psychological profile of students gives insight in students' relations to life and education. It is necessary to create a model based on accessing students according to their personality type which will help in directing them through their schooling. People are not often aware that it is possible to direct both positive and negative traits. It would be useful if students were taught to improve their positive characteristics and correct the negative ones. The result would be making young professionals who are satisfied and productive. The results are oprimistic, showing that the students are mainly extravert, open, conscietious and agreeable with an average neuroticism.

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Model for Teaching Agile IoT Systems Development

M. Malić*, D. Dobrilović**, Ž. Stojanov**, D. Malić***, M. Marcu****
*Panonit, Novi Sad, Republic of Serbia
**University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
***Technical College of Applied Sciences, Zrenjanin, Republic of Serbia
****Politehnica University of Timisoara, Republic of Romania
milanmalic@outlook.com, dalibor.dobrilovic@uns.ac.rs, zeljko.stojanov@uns.ac.rs, dusan.malic@outlook.com, marius.marcu@cs.upt.ro

Abstract – According to the industry trends it is important to say that both agile development and IoT systems deserve attention in contemporary university. Agile development as well as IoT systems and protocols have found its place in academic curricula. Still, teaching both concepts and its effective integration in the curricula remains a difficult task. In this paper a model for teaching agile IoT system development planned to be introduced in master curricula for subjects related to data communications is proposed. This approach is built upon the model of developing a smart building systems based on open-source hardware and micro-services. Together with the proposed model of teaching agile development in IoT micro-service based systems, the supporting platform is presented in this paper.

I. INTRODUCTION

Both agile development [1, 2] and IoT systems have a great importance for the industry. Agile development has found its place in academia and many educational institutions incorporated it in their curricula. The same story happens to IoT recently. However, teaching both concepts remains a difficult task.

In this paper a model for teaching agile IoT system development introduced in IT master degree curricula for the Advances communications course is proposed. The similar model can be applied for any data communication related course. The agile approach is planned to be used in the curricula for developing a smart building system based on open-source hardware and micro-services. The planned system has a number of functionalities such as RFID personnel tracking, RFID inventory tracking, indoor and outdoor monitoring features, video surveillance etc. This paper is result of joint efforts and long experience of academy lecturers of three educational institutions from two countries (Romania and Serbia) and expert from an IT company.

The paper is structured as follows. In the next section, after the introduction, the examples of the curricula based on IoT micro-service based architecture development are presented. The platform is introduced in the next section, and the teaching model together with the detailed process of organization and task scheduling of lectures and student work during semester is introduced. The conclusion and discussion is presented in the last section.

II. RELATED WORK

According to [2], software architecting and agile development have received big attention in academia and industry and many educational institutions address software architectures in their curricula. There are different approaches in their integration in curricula. In [3] authors have designed a special course within software engineering curriculum. The course takes into account the industrial needs in process of teaching. The course is focused on teaching problem understanding and solving software architecture design problems. In [4] authors proposed holistic approach for teaching agile software engineering, in which the required agile practices and values are integrated theoretically but also practically applied. This approach is repeated until they become a habit to students and software engineers. The model of software engineering module that especially addresses agile methodologies with a high emphasis on teaching collaboration practices and agile values is presented in [5].

The growing importance of introducing the IoT system development in university curricula is also present. Authors of this paper present [6] the platform built upon the open-source hardware and software for teaching IoT technologies. This platform is used in IT engineering curricula. The simplicity of open-source hardware allows its usage in educational curriculum even for students of the liberal arts [7]. In this paper, the proposed platform aimed at construction of an IoT prototype system is used to teach students in child education and childcare courses. In [8] the methodology and technique to organize, conduct and evaluate the practical course in IoT that involves industrial and entrepreneurial partners is presented. This paper is additionally focused on particular technologies and open-source IoT middleware that could be used for teaching and research purposes.

The guidelines for the development of agile and IoT based systems in home automation are presented in [9, 10]. The examples of IoT based building automation systems are presented for smart grid [11], security [12] and energy control applications [13]. Because of its complexity, IoT based building automation system of the higher education institution (Technical Faculty "Mihajlo Pupin" building) is used for a learning platform. This choice has many other advantages including easy expansion and modification of the system specification, availability of equipment and accessibility of the space for implementation and testing, etc.

III. THE LEARNING PLATFORM

The learning platform is named *SmartMP*. It is IoT micro-service based smart building system. System has a number of planned functionalities such as RFID personnel tracking, RFID inventory tracking, indoor and outdoor monitoring features (temperature, air quality, lightning monitoring), video surveillance etc. (Fig. 1). These features are specified but not fully developed. The development of these features is used for teaching students during semester and will be assigned as projects to them.

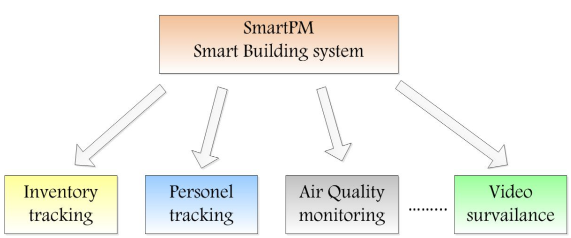

Figure 1. Smart building SmartMP platform structure with features

Each feature can be divided in four segments. The first segment is development of the hardware needed for the project, the second segment is development of UI (user interface) or front-end application, the third segment is development of micro service-based application (middleware) and the fourth segment is the development of relational or non-relational database. It is important to notice that there are no dependencies between features and they can be developed and integrated in the system independently. The examples of the segments will be given in the description of teaching model, in the next section.

SmartMP learning platform is planned as a complex IoT system with the purposes of enabling smart building functionalities. This system has several planned features. The main features of the system are:

- *RFID tracking* – the RFID tracking can be divided in two main sub features. First sub feature can be (1) *RFID personnel tracking*, where personnel (academic stuff, faculty employees and students) can be tracked in various scenarios such as time of arrival and departure to the work, classroom attendance, classroom usage, etc. The second RFID sub feature can be (2) *RFID inventory tracking*, such as the database of inventory of the institution, etc.,
- *Building monitoring* – can be also divided in few sub features such as: (1) *Temperature monitoring* where basic parameters such as temperature or humidity of indoor spaces can be monitored, (2) *Air quality monitoring* – where the indoor pollutant gases, dust and similar parameters can be monitored in order to detect hazardous situations, smoke and fire, (3) *Luminosity monitoring* – the sub feature for monitoring of indoor lighting and luminosity in order to optimize the power consumption for lighting and the safety of institution rooms,
- *Data center monitoring* – can be used for monitoring indoor or device temperature parameters, power consumption and similar parameters related to energy efficient and safe operation of vital infrastructure components,
- *Indoor positioning* – this sub features can be used for monitoring personnel location, and indoor navigation. This feature is usually built on RSSI of wireless signal measurements,
- *Video surveillance system* – the security feature of institution monitoring with advance features of image processing, facial recognition, etc.

The list of proposed features is not final and can be expanded in future.

The learning platform has its pre-requirements. In order to be used in the classroom in the planned way, it needs to have defined resources to be used in the system. These defined resources are *SmartMP framework* and it includes model of the institutional building. These resources are: classrooms, offices, amphitheaters, laboratories, inventory, computers and network devices, etc. This definition should be done in formal format, such as UML, and has to be defined by lecturers.

The *SmartMP* system has multiple components such as: hardware, IoT protocols, micro-services based architecture, non-relation and relation databases, and advanced communication technologies. Its complexity gives the opportunity for multiple groups of student to develop complex features improving their skills with team work and solving complex tasks. Hardware components of the system relay on open-source hardware [7, 14, 15] and a single-board computers (SBC) such as Raspberry Pi. Both open-source hardware and single-board computers are very reliable and low-cost prototyping platform for building variety of systems [16]. The usage of open-source hardware for building low-cost Heating, ventilation, and air conditioning (HVAC) system is presented in [14]. The authors propose usage of the same platform for building home automation systems [15]. In this paper the authors suggest usage of Arduino/Genuino node with sensors and wireless communication NRF24L modules.

IV. THE TEACHING MODEL

The teaching model presents the main contribution of this work and will be presented in this section. It uses *SmartMP* platform as its basic tool. The teaching model assumes that the prerequisites in the form of *SmartMP* framework are needed for the feature development, as it is presented in previous section. The model also assumes that one or more features can be developed by the group or multiple groups of students during one semester (depending on the number of students that are signed for this course). The next generation of students will develop another features, using the same or expanded set of prerequisites and features developed by the previous group of students. In that way, the model becomes circular and usable for generations of students. If, during the long period, all planned features have been completed, students can develop improved versions of existing features.

It is important to say that students before entering this course should have knowledge of work with databases, understanding of technical documentations, object oriented programming skills in programming languages C#, C/C++, Python, JavaScript, communication technologies and communication protocols basics, security, operating systems, etc. All enlisted skills represent knowledge gained during the previous studying period.

V. THE MODEL IMPLEMENTATION

In this section the implementation of the proposed model is described. As it is presented in the previous section, the model and its learning platform (*SmartMP*) has a number of planned features. All planned features have four segments (hardware, front-end, middleware and database segment). The group of 3 to 5 students can be assigned for the development of one segment. As an example, in this section will be described development of the four segments for the *RFID personnel tracking* feature.

The *RFID personnel tracking* feature has the purpose of tracking the academic stuff, students and other employees of the institution. This tracking can be used for arrival and departure records, working hour records, classroom and laboratory usage, etc. The hardware segment (1) covers the design of the system based on open-source hardware platform such as Arduino/Genuino UNO or similar. This segment includes design of hardware platform based on chosen RFID standard, data format specification, choice of the communication technology for data transfer and other RFID device components. The selection of RFID standard includes the choice of suitable RFID readers and tags to be used in the project. The data format specification defines the type and output data format to be acquired, e.g. ID card data, time, location ID, etc. The communication protocol choice includes usage of wired communication technologies (Ethernet) or wireless technologies (IEEE 802.11, ZigBee, Bluetooth, etc.) or their combination. The additional components of RFID device will be defined in accordance to the specified data format and required functionalities for the device. In accordance to specific requirements, the device depending of data type can have display (LCD or OLED), beeper and LEDs. If the time of reading is required, the device will have RTC clock. Depending of the chosen protocol the device will have suitable communication module integrated. Additional components of the device can be distance and motion detection sensors, etc.

The second (2) or middleware segment covers the design of micro-service based platform for handling RFID tracking including IoT protocols and communication technologies used. The third segment (3) covers UI or Front-end features, together with the data visualization, data analyses and reports. The fourth segment (4) covers the database development for storing retrieved data, including micro-services for DB connections and DB design.

The development process of one feature is presented in Fig.2. Four groups with 2 to 5 students are assigned to one feature segment. The number of students in a group depends on the number of student attending the course and/or the complexity of the task.

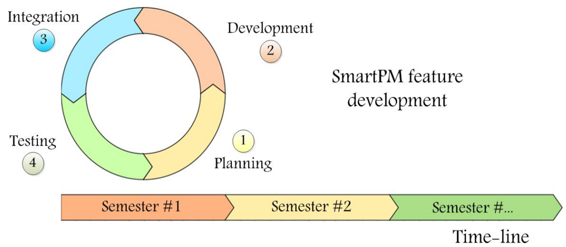

Figure 2. Phases of the feature development

The lecturers assign the tasks to the working groups and define outputs and inputs of each segment. This action gives to the lecturers the role of product owner according to agile methodology terminology. Also, lecturers define communication between groups. The teams work with the principles of the agile programming. Their work is divided in four phases. Those phases are presented in Fig. 2.

The first phase is (1) *Planning phase*. In this phase the students gain knowledge about the system using existing UML documentation. After that, they discuss on design of the system and plan their future work for the feature development. They have to choose suitable technologies and establish the basic design. The duration of this phase is 2 weeks. The first phase may include following steps:

- Introduction to the existing system and *SmartMP* framework,
- Introduction to the problem to solve and assigned task,
- Presentation of potential solution, drawback and difficulties to the rest of the team, etc.,

The second phase is (2) *Development phase*. In this phase the students work on development of the system in accordance to the plan and design from the first phase. The duration of this phase is 6 weeks.

The pre-requirements for the second phase are object-oriented programming skills and knowledge about system acquired in the first phase. All activities are focused on developing student sense for the team work. The second phase covers:

- Continuous integrations of the developing solution in the system,
- The tool selection and practice (Git, Github) – knowledge of the tools for managing versions and software changes during development,
- Learning about communication protocols, focused on IoT systems, and
- Development of the system.

The third phase is (3) *Integration phase*. In this phase the students integrate their solution in one feature. The coordination and team work with all other groups should be applied. This phase covers the integration in the system using Git tool. This phase also includes effort estimation – or estimation about complexity and duration of integration in the system. Depending on the feature complexity, this phase should be 3 weeks long, but it can last only 1 week.

At the end, the fourth phase (4) or *Testing phase* includes testing of the solution. If some problem occurs, one or more working groups cooperates on the resolving the problem individually or as a team. The duration of this phase is 2 weeks. In the last phase both students and lectures test the solution, looking for possible bugs and trying to fix problems. This phase is also focused on developing team working skills. The grading of the students work starts in this phase and continues to the last week of semester.

After the completion of the fourth phase, the feature is committed as finished. The duration of all four phase is 13 weeks. Suggested phase durations (2, 6, 3, 2 weeks respectively) can be changed depending of the feature complexity, but no longer than 13 weeks in total. Considering that the semester has 15 weeks, one week at the beginning of semester is reserved for the lecturer to make introduction and to assign tasks to student groups. The last week of the semester is reserved for student presentations of their work and grading.

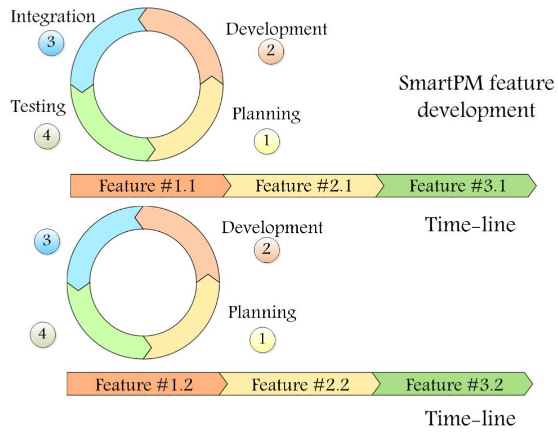

Figure 3. Parallel development of the SmartMP features

If there are more students that attended the course, the parallel development of two or more feature can be deployed. In Fig. 3 the parallel deployment of two features is presented. In this case, the two features can be developed independently. The four groups of students work on feature #1 (e.g. *RFID personnel monitoring*) and other four group of students work on feature #2 (e.g. *Temperature monitoring system*).

VI. CONCLUSION AND THE FUTURE WORK

In this paper the model for teaching IoT system development based on micro-services is presented. The proposed model is presented on the example of the integration of this model in curricula of the Advanced Communication course in IT master degree. The model is based on open-source hardware platform and micro-service based architecture and created as a result of joint efforts and experience of university lecturers and IT professionals. The detailed description of the model integration in curricula is presented in this paper.

This model is still in development phase, and it is not yet implemented, tested and evaluated in the classroom.

Because of the type of the course, the focus in this model is given on communication technology implementation, data transfer and protocol specification. There is a possibility to adopt proposed model for other courses in the curricula. Depending on the course content, the focus can be changed to database development, Big data, embedded system design or software architecture.

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Communication and Use of Modern Technologies in Teaching Processes in Primary Schools of Serbian and Romanian Banat

St. Banjanin*, S. Popov**, Sa. Banjanin***
* Ministry of Education, Science and Technological Development, School Management, Zrenjanin, Republic of Serbia
** Faculty of Sport and Tourism TIMS, Novi Sad, Republic of Serbia
*** Cultural Center, Zrenjanin, Republic of Serbia
sbanjanin@gmail.com

Abstract - Computer and computer information and communication technology (ICT), as a specific form of communication, were to take an important place in the modernization of the teaching process at the beginning of the 21st century, given the invasion of digital technologies in all pores of modern life. The latest being the digital revolution having been spread all over the world like wildfire in the last few decades, uninterruptedly seizing all continents, no matter the religious, national, educational or material status of the consumer. Everyday life is absolutely unimaginable without the use of the Internet and new technologies. However, the use of ICT in teaching process in our country is not nearly enough well prepared, planned, designed, or present in lectures to the desired extent, and therefore cannot give results which could be recorded like in the countries in which these processes are timely realized.

The subject of our research is communication in educational institutions and the use of ICT in the teaching process. The total sample of the survey was 1874 respondents, the students and the teachers of 7th and 8th grades, headmasters and professional associates from 12 primary schools from the Serbian part of Banat, and 14 primary schools from Romania. The results of the research have indicated that teaching in both countries is mostly traditional, without the proper use of ICT, and that there has been no significant change in classroom communication. We believe that it would be of great importance to conduct more detailed research on the use and application of ICT in teaching, because we have proven that students are much more satisfied with such classes, and that it improves the quality of work and communication. However, teachers are not trained and competent in the use of ICT, so the existing application is reduced to improvisation and enthusiasm of a smaller number of individuals, which cannot be defined as a systematic approach and as such cannot give the expected result.

I. INTRODUCTION

When establishing a critical attitude towards today's teaching in Serbia, which is still a traditional one for the most part, the question arises as to whether the use of computers in lessons is more effective than the classic, most commonly used forms and methods of work? On one hand, there is a personal impression and an undeniable, tangible advantage that modern technological means allow us: in the speed of work, motivation, in the obviousness of the teaching process, mostly uncomplicated gathering of nearly incredible amounts of essential data, references etc.. On the other hand, there is a logical question that arises and it is: does the application of ICT in the teaching process, which is promoted by almost all contemporary pedagogues, really improves communication, and therefore the quality of teaching, and the students' achievements? The latest research in the world shows that computers are teaching tools that allow for the organization, control, management of teaching process and learning through a permanent link between teachers and students, which motivates students and provides a good basis for evaluation and fair assessment of their work. The application of ICT enables a completely new organization of educational work, stimulates individual skills and students' interests, and ensures faster and more efficient broadcasting, transfer and acquisition of knowledge

However, researchers are not unanimous on assessing the degree of success of computers in teaching. "Autonomy should be encouraged, but not to the extent that children become 'lost' in the mass of information produced by a poorly focused search. The search skill is not inherent or innate, but rather learned. (...) Technology should not be allowed to dominate the lecture. If there is a better way to achieve learning goals that do not involve the use of the Internet, then it should be used."

In this paper we will try to investigate to what extent and how ICT is present in the teaching process of the final grades of primary schools in Banat, both Serbian and Romanian, or what is the role of ICT in student motivation. We will investigate whether the teaching process, in classes in which new communication tools are applied, is more interesting, more receptive, or better.

Are these resources really necessary in our schools, and does the quality of teaching process depend on their use? We will compare the teaching process in which there is a significant application of ICT with the so-called classic teaching, most often present (mostly frontal). We will point out the importance and the necessity of introducing ICT in teaching, also in the programs of all pedagogical faculties where future teachers prepare for work in the classroom.

II. Research results in Serbia and Romania

The basic idea that we did a part of the research in the Romanian part of Banat as well, in the schools in Timisoara and its' vicinity, was to compare the assessments and attitudes of our teachers, pupils and school managers with the assessments and attitudes of teachers, pupils and school managers from Romania, which is a member of the European Union (EU). Following the processes that bind our country in the preparations for eventual admission to the EU, we have assumed that there are common attitudes and developments in education in the EU, as there are in many other areas. We expected that Romanian schools, although Romania has not been a member of the EU for long, would be at a much higher level in terms of organization of teaching process, external evaluation, adherence to the children's rights, that in the schools of our neighbors there would be much more use of ICT, that they are much better technically equipped, that the quality of communication in classes is at higher level, etc...

Comparing the results of the research on communication in the teaching process, we found that there are no significant differences in the overall analysis of respondents' results from both Serbia and Romania. It is worthy to mention that Romanian teachers emphasize the quality of communication as significantly higher than their students. The same goes for the part of the answers that assess the non-violence and cooperation.

In a sense, there are cultural, historical, sociological, and political similarities of the people living in the territory of Banat. This toponym also includes both the Serbian and the Romanian part of the region. However, the difference in economic development of Serbia and Romania, the negative political circumstances caused by our country's 10-year isolation, and the entry of Romania into the European Union, led us to the idea that it would be interesting to compare certain segments of our and Romania's educational process. We were interested in how our neighbors advanced in relation to us in communication, application of ICT, work methods and forms, and the application of the quality standards that they introduced into their system.

A. Link between the use of ICT in teaching and quality of communication in the learning process according to student assessment in Romania

The relationship between the use of modern communication tools in teaching and the quality of communication was measured by Pearson's correlation coefficient on the total scores on TheQuestionnaire on the use of modern communication tools and scores on The Questionnaire on the quality of communication during classes. The results are shown in Table 1.

Table I. THE RESULTS

	Communication in classes	Non-violence and cooperation
Use of modern communication tools in teaching	.447**	.424**

**p ≤ .00

In Table 1, we can notice a statistically significant correlation between the use of ICT in teaching for both factors on the Communications Questionnaires, for both the communication during the teaching itself ($r = .45$), and for the general atmosphere of encouraging cooperation and non-violent communication ($r = .42$). Both correlation coefficients are significant at $p \leqslant .001$ level. These results indicate a moderate positive association between the use of ICT and communication between students and teachers. In other words, the greater use of ICT in teaching is associated with a better assessment of communication by students in Romania, as well as by encouraging an atmosphere of non-violence and cooperation. This exact result was also obtained from students in Serbia as well.

B. The difference in the use of ICT in teaching according to the assessment of students from Serbia and Romania

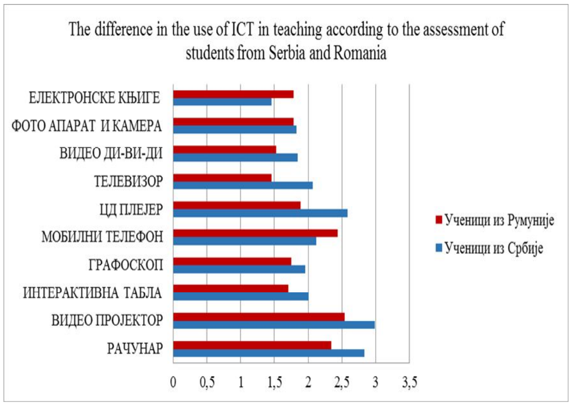

Figure 1. The difference in the use of ICT in teaching according to the assessment of students from Serbia and Romania

In Chart 1, we see that students from Serbia are more referring to the use of all other ICTs, except for mobile phones and e-books. Which of these differences are statistically significant? For this purpose, we used a T-test for independent samples. The results are shown in Table 2.

Table II. DIFFERENCE IN ASSESSMENT OF THE USE OF ICT IN TEACHING BETWEEN SERBIAN AND ROMANIAN STUDENTS

	t	df	p
Computer	9.00	1505,2	.00
Projector	7.86	1505,2	.00
IT	4.58	1504,3	.00
Graphoscope	3.47	1505,2	.00
Mobile phone RS	-4.41	1505,2	.00
CD	11.03	1505,3	.00
TV	10.18	1505,2	.00
DVD	5.73	1505,2	.00
Camera	0.81	1504,3	.41
E-books	-5.15	1505,1	.00

We can see that a statistically significant difference in the estimates of the use of individual ICTs exists in all the listed means, except for the camera.As it can be seen in the previous picture, only e-books and mobile phones (in our schools are all but prohibited, e.g. SB) are more used in Romania, while other means are used more frequently in respondent schools in Serbia, according to student assessment.

Table III. AVERAGE ANSWERS ON STUDENTS' QUESTIONNAIRE USE OF MODERN COMMUNICATION TOOLS IN TEACHING

		AS	SD
1.	The school uses modern technical means (computer, projector, video, interactive board, etc.) for teaching purposes.	3.33	1.25
2.	I think that classes with modern technical means are more interesting than lessons when it is not the case.	4.04	1.26
3.	Teachers know how to use modern technical means for teaching purposes.	3.68	1.21
4.	Teachers often encourage the use of the Internet for teaching purposes.	3.24	1.30
5.	We have the opportunity to communicate with teachers via the Internet (email, or social networks) for teaching purposes.	2.77	1.44
6.	I understand the material that is presented in school more clearly with the help of modern technological means.	3.69	1.28

As with a sample of students' answers from Serbia, it is evident that students find classes more interesting if modern technological means are used.

C. The difference between student responses in Serbia and Romania on the questionnaire Use of modern communication tools in teaching

Table IV. DIFFERENCE BETWEEN STUDENT RESPONSES IN SERBIA AND ROMANIA

	t	df	p
1. The school uses modern technical means (computer, projector, video, interactive board, etc.) for teaching purposes.	10.13	1505,2	.00

2. I think that classes with modern technological means are more interesting than lessons when it is not the case.	4.19	1505,2	.00
3. Teachers know how to use modern technological means for teaching purposes.	1.06	1505,2	.28
4. Teachers often encourage the use of the Internet for teaching purposes.	-.20	1504,3	.83
5. We have the opportunity to communicate with teachers via the Internet (email, or social networks) for teaching purposes.	1.40	1505,2	.16
6. I understand the material that is presented in school more clearly with the help of modern technological means.	3.40	1505,2	.00

In Table 4 we can see that there is a statistically significant difference in items 1, 2 and 6, infavorof pupils from Romania. Romanian students believe that they use more modern communication tools, that teaching with these resources is more interesting and that the material presented in this way is easier to understand. Although the previous analysis showed that the assessment of the use of ICT resources was mostly better among students in Serbia, different results were obtained in this analysis. This may mean that students in Serbia are more dissatisfied with these aspects of teaching, even though they estimate that the use of individual ICTs is more present than pupils in Romania.

D. Comparison of Serbian and Romanian teachers' assessments of the quality of communication in the teaching process and the use of modern communication tools in teaching

We compared the responses of teachers from Serbia and Romania according to the scores on the dimensions of the Questionnaire for measuring communication in teaching and the total score on the Questionnaire for assessing the use of modern communication resources in teaching. For these purposes, we used the T-test for independent samples, where the dependent variables represented the scores on the individual dimensions of the aforementioned questionnaires, and the grouped (independent) variable was made by the country in which the teacher works. The results are shown in Table 5.

Table V. ATTITUDES OF TEACHERS FROM ROMANIA AND SERBIA TOWARDS COMMUNICATION IN TEACHING AND USE OF ICT, AND VIOLENCE

	t	p
Communication in teaching	-.563	.55
SKS score	-1.13	.25
Non-violence and cooperation	-3.12	.00

Note: df-number of degrees of freedom (365.2)

The results in the table indicate that a statistically significant difference exists only on the dimension of Non-violence and Cooperation, in favor of teachers from Serbia. This means that teachers in Serbia assess this aspect of the teaching process as more represented than teachers in Romania.

E. The difference between teachers in Romania and Serbia on individual responses on the Questionnaire on the use of modern communication tools in teaching

Table VI. DIFFERENCE BETWEEN TEACHERS' RESPONSES IN ROMANIA AND SERBIA ON THE USE OF ICT IN TEACHING

		t	p
1.	The school uses modern technical means (computer, projector, video, interactive board, etc.) for teaching purposes.	2.61	0.09
2.	I think that classes with modern technological means are more interesting than lessons when it is not the case.	-0.25	0.79
3.	Teachers know how to use modern technological means for teaching purposes.	0.969	0.33
4.	Teachers often encourage	2.17	0.03

	the use of the Internet for teaching purposes.		
5.	We have the opportunity to communicate with teachers via the Internet (email, or social networks) for teaching purposes.	-1.26	0.20
6.	I understand the material that is presented in school more clearly with the help of modern technological means.	1.26	0.20

The difference is significant for the claims 1 and 4, in favor of teachers from Serbia. This means that teachers from Serbia to a greater extent assess that the use of modern technological means is present in their schools, and that teachers are more likely to encourage the use of the Internet for teaching purposes.

III. CONCLUSION

The general digitization of the society and the world in which we live is quickly taking over and it is impossible to ignore it, so the use of ICT in our schools is inevitable. The introduction of ICT, as a compulsory subject, into primary schools, from the school year 2018/2019, is a long-awaited inevitability. Initiatives for such a decision by the relevant institutions in our country have been in existence for several years, although we are still falling behind compared to most of Europe and the developed world. Therefore, it is no longer a question of whether ICT should be introduced in teaching, when the more appropriate question would be: how and in what way is it best to do it? As soon as possible! The current process of adapting teaching to the inevitable modern trends in our schools has been reduced to improvisation and individual resourcefulness of teachers, but it is not even nearly closeto what a systemically prepared and initiated course of action should be. Many domestic and foreign authors agree in the statement that the reason behind the lack and omission of the use of ICT in teaching, above all, is the unpreparedness and lack of knowledge of teaching staff. Teachers in our country do not possess the competences for introducing ICT in the teaching process.

Programs at faculties of education should inevitably include specific areas related to the improvement of the communicative competencies of teachers, as well as the methods and techniques of using ICT in teaching, because this area is not in a proper and satisfactory way present at faculties that educate teachers and prepare them for practical work in schools. Therefore, we hope that the changes in education will include much wider space, with a significant networking of all institutional levels, because only in this way can the so desired and expected reformation of the entire educational system be achieved.

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Primary School Principal's Role as a Leader

N. Petrović*, D. Sajfert**, E. Terek*, M. Vulović*, J. Rajković***
*University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
** College Dositej, 11000, Belgrade, Bulevar vojvode Pitnika 7, Republic of Serbia
*** Faculty of Engineering Management, Belgrade, Republic of Serbia
petrovic.n26@gmail.com

Abstract - In their research, authors point to factors that influence the leadership role of primary school principals. The manager (principal) of the school controls the process of teaching performed by individuals or groups of teachers, the operation of the school, the contacting of the Ministry of Education, etc. Based on the information obtained in this empirical research, which was conducted in 52 primary schools in the Republic of Serbia and the province of Kosovo and Metohija. Conclusions about the primary school principal's role as a leader will be carried out. In this research, statistical methods were used that are the basis of the conclusion on the validity of the hypotheses and the validity of the conclusions made through the procedure of determining the statistical significance of the differences between the principals by analyzing the variance. It has been proven that among primary school principals there is a lot of difference in understanding obligations, in relation to teachers, in the frequency of visiting professional seminars, etc.

I. INTRODUCTION

The management of the school is to encourage and ensure the quality development of new pupils knowledge, to provide support and incentives for acquiring knowledge from external sources and developing the ability to apply and use them. The school should ensure that new knowledge is distributed to pupils who need it to be successful, and that everyone knows where and how it can be gained. In short, the purpose of school management is to maximize effective school-related activities related to knowledge. The school manager should monitor, encourage and facilitate all activities related to knowledge, to train and improve the knowledge infrastructure in a saturation manner. The school manager creates, renews, builds and organizes teachers as school subjects to efficiently distribute the acquired knowledge in the teaching process. Successful leaders must have a realistic view of communication and its direct and indirect effects [1].

II. RESEARCH RESULTS OF HANDLING IN PRIMARY SCHOOLS

In recent times, a particularly current and interesting problem has become the exploration of the full structure of management for three reasons:

1. Modern societies and schools are increasingly vulnerable to cultural and other forms of discrimination at work;

2. The diversity and the superiority of the so-called. "Female management style" [2]. applied to new business conditions and the role of managers, focused on the maximum development and use of human resources, as the most important property of each school;

3. Managing diversity, which includes full diversity, becomes a very important orientation and preoccupation of modern managers and schools. The full structure of the analyzed executives is shown in Figure 1.

When it comes to managers' gender expressed by percentage, there is a statistical significance between the sexes in which men or women are leaders, indicating that women are, as a rule, far less likely to be in managerial positions, as shown in Figure 1. Figure 1 shows very clearly the male dominance in leadership, which is almost absolute. It is evident from the very picture that women are in a subordinate position.

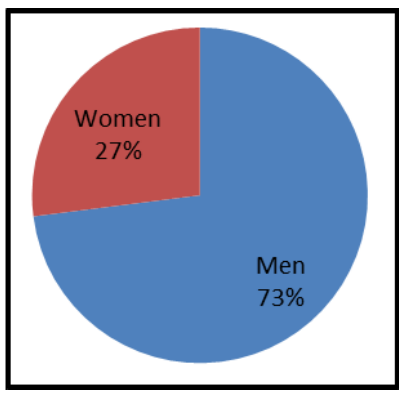

Figure 1. Distribution of respodents' genders

An interesting figure is the age structure of executives. It is to be expected that the age structure with structure is related to the sexes. Therefore, some questions may arise. How many years should the managers have? What age and how much work experience are optimal for taking a managerial position and entering a managerial career. Is it a big or a small number of years, that is, the age of an obstacle or an advantage in performing a managerial job? What experience and age are needed and are they relevant to performing the most important managerial positions? Tea issues are often related to the analysis of management, managerial work and the performance of a managerial function. Since there are no unique and ready-made answers to such a complex job and positions, the logical way to answer is an analysis of the age structure of the current school leaders, which is illustrated in Table 2 in this case.

Table 1. AGE STRUCTURE OF EXECUTIVES

Groups	Number of respondents
up to 30 years	0
to 31-40 years	7
to 41-50 years	19
to 51-60 years	23
More than 60 years	3
In total	52

As can be seen in Table 2, and in the analyzed sample of school managers, the largest group of managers is 51-60 years of age (24%). What is, it seems representative of the general managerial situation in education. Generally, the age distribution of managers, which is logically asymmetric and shifted towards older ones (20% are people aged 41 to 50). Although the trend of rejuvenation of managers has been present in the last years, so the people of the 1930s and early 40s began to appear, the general general rejuvenation of the management structure is a long-lasting process, and it is slightly below 20% of the principals at the age of 31-40 years. It can be noted that very young principals are not even a rule in the world and it is difficult to assume the dominance that they will be dominant for a period of up to 30 years.

Although it is not possible to put a sign of equality between school and level of education of managers, since principals are educated outside the usual system of education, it is nevertheless assumed that a certain level of schooling is assumed as mandatory for the performance of the school principal. Figure 5 shows that most of the examined principals have the most from educational sciences (13 respondents, of which 10 are men and 3 are women). There are technical science behind them (11 respondents, of which 8 are men and 3 women). The next in number are pedagogues (8 respondents, of which 7 are men and one woman). Principals who completed natural sciences are the following (7 examinees, of which 5 are men and 2 are women). The following are those who have completed social sciences and economics, of which there are 4 men and 2 women in both groups). The smallest number were respondents from legal sciences (1 respodents and 1 woman).

When it comes to school principals, the problem of governance in Serbia is not formal education, which is high, but the possession of the real business and managerial knowledge needed for modern school operations, which often lag behind formal education, as indicated by a particular diploma. The content of educational programs of our faculties, especially economic ones, which offer an enviable level of managerial knowledge, are compatible with the same or similar programs at the most famous West European and North American unconventions. Of course, this knowledge is still not accompanied by appropriate managerial practice.

Table 2. EXPERT ASSESSMENT OF RESPONDENTS

Expert assessment of respondents	Number of respondents	Gender male	Female gender
graduate pedagogue	1	1	0
social science	6	4	2
economic	6	4	2
pedagogue	7	6	1
legal science	1	0	1
natural Sciences	7	5	2
education	13	10	3
technical sciences	11	8	3
In total	52	38	14

Respondents in Table 2 are classified according to the professional grade according to the charts where the educational sciences are the most dominant, and the least represented are lawyers. Figure 3 shows that there are 13 principals from the educational sciences, of which there are 10 men and 3 women. Next in the ranking are pedagogues with 8 and 7 men and 1 woman. Natural sciences have 7 principals with a ratio of 5 men and 2 women. There are 6 economists in social sciences in elementary schools, of which in each group there are 4 men and 2 women. A graduated pedagogue is one and the same man. The issue of seniority, which is sometimes a bad omen in us, is in fact a matter of attachment to a company and a loyalty to the company in which a person works, as well as internal career development in general, and especially managerial careers that require time and, as a rule, progress through different work and managerial positions.

The career development of primary school principals is basically a long-term process of building and spreading different skills and knowledge, developing and confirming personal managerial potentials and competencies, as well as acquiring the business experience and skills necessary for running a school. For this, it is necessary to have a different time, a job, very often related to the school where someone comes to the position of principal. If the principals are analyzed in more detail, we can conclude that the larger structure of the larger structure consists of those who have three changed jobs (around 48%). Behind them are principals who changed four early places (about 27% of them). In the third place are principals who changed two jobs (around 21%). Other principals and the change of working masters have no statistical significance.

Table 3. NUMBER OF CHANGED JOBS

Number of changed jobs	Number of respondents	Gender male	Female gender
I	1	0	1
II	11	7	4
III	24	18	6
IV	14	12	2
V	2	1	1
In total	52	38	14

The distribution to the poles of the respondents and job changes is shown in Table 4. In the first place are the principals who changed three jobs. Male principals who have changed three jobs are represented with about 35%, and women with around 12%. Male principals who changed four jobs are represented by 23%, and women with slightly less than 4%. Male principals who have changed two jobs are represented by slightly more than 13%, and women with slightly less than 8%. Other principals and distributions according to the poles of the respondents and the change of working masters do not have any statistical significance. Table 4 shows how much time executives spend on planning, organizing, managing human resources, managing and controlling, as the basic management functions. How much time they spend on other management segments such as decision making, communication and employee motivation. It is evident from the table that medium-sized planning, decision making, human resources management and motivation are present. There is a lot of time for the principal to organize, communicate, manage and control.

Table 4 shows how many time managers spend on individual management functions. 28 planners spend their time most of their time, then 20 spend a lot of time, while 4 of them spend a little time planning. In making decisions, 41 spend a mean amount of time, 9 spend a lot of time, only 2 principals spend a little time making a decision. 29 principals spend a lot on organizing. 23 principals spend medium time, and for a little time to organize there is not one principal.

Table 4. MANAGEMENT TIME

Time spent for managing	Little	Medium	Much	In total
Planning	4	28	20	52
Making decisions	2	41	9	52
Organising	0	23	29	52
Human Resource Management	14	31	7	52
Communication	1	24	27	52
Motivating	4	32	16	52
Guidance	5	18	29	52
Control	2	21	29	52

For managing human resources, the average time is spent 31, while 14 principals spend a little time, and only 7 principals spend a lot of time. On communication, principals have declared that they spend a lot of time on the 27, medium-sized 24, and only a few of them spend a little time. Motivating as a management segment 32 managers use medium time, 16 spend a lot of time, and only 4 spend a little time. Leaders said 29 principals had been asked to spend a lot of working hours, 18 declaring that they were spending time on guidance, and 5 of them had little time to lead. Control is widely represented in 29 principals, 21 using medium-time control, and only 2 principals use little control time.

The school principals in Table 5 have stated that their activities in defining the strategy are in the ranking of 1 of them 20, in the rank of 2 of them 10, in the rank of 3 of them 11, in the rank of 4 only 2 and in the ranking 5 of them 4. For attaining the goals in the first rank 18 of them were ranked in rank 2 19, ranked 8, ranked 4 2 and ranked 5 in 4. 4. Principals voted to organize in the first rank of 12, in the rank of 2 of them 26, in the ranking 3 of them 7, in the ranking 4 of them 3 and in the ranking 5 of them only 2. For the selection of the right associates in the ranking 1, 7 principals voted, for the ranking 2 of them 17, for a rank of 3 19, for a rank of 4 5 and for a rank of 5 7. Motivation of the workers in the first The ranking is 5 principals, in the second ranking 17, in the third 20, in the fourth 8 and in the peak only 2. For the development of the employees, the principals have declared themselves in the first ranking with 3 principals, in the second 12, in the third 20, in the fourth 7 and in the fifth 9 For the development of organizational culture in the first ranking, 1 principal was elected, in the second ranking 4, in the third 21, in the 19th and in the fifth one. 2. School principals declared themselves def initiating business policy in the first ranking 3, in the second 10, in the third 18, in the fourth 14th and the fifth 4th. The cost control rating of the school principals is as follows: In the first rank is 13, in the second 22, in the third 10, in 4th and 5th.

Table 5. RANKING OF ACTIVITIES ACCORDING TO IMPORTANCE

	Rank				
Activities	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
Defining strategy	20	10	11	2	4
Setting goals	18	19	8	3	3
Organizing	12	26	7	3	2
Choosing the right associates	7	17	19	5	7
Motivating employees	5	17	20	7	9
Development of employees	3	12	20	7	9
Developing an organizational culture	1	4	21	19	2
Defining business policy	3	10	18	14	4
Spending control	13	22	10	4	1
Other	0	0	0	0	0
In total	82	137	134	65	34

Ranking of activities according to importance is shown in Figure 6, so in the first rank, defining the strategy, in the second ranking of goals, organizing and controlling costs, in the third, the selection of right associates ranks, motivating workers, employee development and defining business policy, and in the fourth rank is the development of organizational culture. Table 6 shows the answers of principals who need knowledge for successful job management. 16% needed for the required technical knowledge, 15% needed economic knowledge, 16% needed organizational knowledge, 12% knowledge needed, 12% computer skills, 9% sociological knowledge, 9% knowledge in psychology, knowledge about behavior of 7% and knowledge from andragogy 5%.

Table 6 shows the necessary knowledge for successful management. 16% needed for the required technical knowledge, 15% needed economic knowledge, 16% needed organizational knowledge, 12% knowledge needed, 12% computer skills, 9% sociological knowledge, 9% knowledge in psychology, knowledge about behavior of 7% and knowledge from andragogy 5%.

Table 6. SHOWS THE NECESSARY KNOWLEDGE FOR SUCCESSFUL MANAGEMENT

The necessary knowledge of successful job management	%
Technical knowledge	16
Economic knowledge	15
Organizational knowledge	16
Knowledge in management	12
IT knowledge	12
Sciological knowledge	9
Knowledge of psychology	8
Knowledge of behavior	7
Knowledge from andragogy	5
In totoal	100

Table 6 shows the skills needed to the manager. Based on the analysis of the questionnaire, it can be noted that in the first rank managers need special knowledge and a good knowledge of the job. According to the principal's responses in the second ranking, the most important are analytical knowledge, communication, morality, change, team work, interpersonal relations and the ability of the whole. In the third rank are working with things, working with people, connecting with the environment.

Table 7. Depicts the necessary knowledge to the manager

	The most important				Not important
	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
Special skills	17	14	15	3	1
Analytical knowledge	11	23	11	3	0
Good job position	25	16	10	1	0
Work with things	12	8	13	12	1
Communication	16	22	12	1	0
Motivating	11	21	11	8	1
Changes	7	19	18	4	2
Teamwork	16	17	14	2	2
Interpersonal relations	7	22	10	9	2
Working with people	6	19	20	2	1
Ability of the continent	4	22	16	5	0
The organization's links with the environment	6	14	20	8	1

Table 7 graphically depicts the necessary knowledge to the manager. In the first rank according to the opinion of the school principal, the most important is the knowledge of the job. In other knowledge, analytical knowledge is the most important. In the third rank, the most important thing is working with people and a vase with the environment. In the fourth rank, it's work with things.

Table 8 shows the ranking according to the importance of knowledge, qualities and skills. Principals answered in the questionnaire that in the first place the ability to organize is in the first place, in the second place the ability to transfer knowledge, in the third place are the ability to quickly decide and high general knowledge. In the second ranking, principals have declared that the ability to organize and innovate abilities in the first place is second, the ability to transfer knowledge is second, and in the third place are high general knowledge and ability to predict. In the third rank, the readiness to take risks is in the first place, the second is the ability to predict, and third place is the knowledge of world languages and the ability to coordinate.

Table 8 graphically depicts the answers of school principals who completed the questionnaire. The first place is the ability of the organization or school. In the second ranking, the ability to organize and innovate is in the first place. In the third rank, the readiness to take risks is in the first place.

Ranking the importance of knowledge, qualities and skills	Most important				Notimportant
	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
High general	15	20	8	5	4
World languages	11	19	15	5	2
Ability of foresight	7	20	20	2	3
Ability of the organization	24	22	6	0	0
Ability coordination	11	18	15	3	5
Entrepreneurial ability	10	19	13	7	3
Innovative ability	12	22	11	3	4
Ability knowledge	17	21	9	4	1
Ability to make decisions	15	19	12	3	3
Willingness to take risks	11	10	23	8	0

Table 8. Depicts the answers of school principals who completed the questionnaire

III. CONCLUSIONS

In recent times, a particularly current and interesting problem has become the exploration of the full structure of management for three reasons; Modern societies and schools are increasingly vulnerable to cultural and other forms of discrimination at work; The diversity and the superiority of the so-called, "Female style of management" [2] applied to new business conditions and the role of managers, focused on the maximum development and use of human resources, as the most important property of each school; Managing diversity, which includes full diversity, becomes a very important orientation and preoccupation of modern managers and schools.

Leadership should create a leadership culture in the organisation and drive the process of learning through challenges [3]. A leader managing an organization has an obligation and responsibility to posses relevant skills, power, ability and influence to lead his employees [4]. Globally, the world is in a state of change, and science and education are a key factor in these changes. New knowledge reveals new horizons and demand, new aging in the implementation of change [6]. Changes in educational institutions require activities within the educational process, that is, in everything that the national education system can improve in a more efficient and effective way of doing business [5].

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Problem-Based Tasks in Teaching Technics and Technology

A. Ilić**, E. Eleven**, M. Pardanjac*, M. Hadzić***,
M. Gavrilović Stamenković**, J. Barbarić****
*University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
**Primary school „Rade Drainac", Belgrade, Republic of Serbia
***Primary school „Vasa Carapic", Belgrade, Republic of Serbia
****University of Colorado, Denver, Colorado, USA
aleksandra.ilic79@gmail.com, eleven.erika74@gmail.com

Abstract - The accent of modern methodic is on active learning. The teacher is expected not only to provide knowledge and skills, but also to show a positive attitude towards innovations. The role of the teacher is to personalize the teaching process, i.e. to enable each student to activate its own existing competences. The teacher creates the situation in which each student activates its own abilities and motivates himself to improve them further. The student understands interconnectivity of school subjects, as well the fact that the knowledge he acquires and widens is part of everyday life. One of efficient forms of teaching which activate, integrate and improve the abovementioned skills successfully is the method of problem-solving. The skills of cooperative and collaborative teaching are the ones which direct students to work together as a group, i.e. some day as part of company's team. In jobs which are created in modern world and local labour markets the following skills are necessary: critical thinking, creativity, collaboration, communication, informatics literacy, technological literacy, flexibility, leadership, initiative, productivity, as well as social skills.

I. INTRODUCTION

In primary and high-school education around the world, as well as in Serbia, the model of frontal teaching, where a teacher gives a speech while students listen, has long been overcome. The accent of modern methodical trends is on active learning, i.e. higher levels of the Bloom taxonomy (application, analysis, synthesis, evaluation, creation). It is the teacher who is the scenarist of active learning. Many educational systems expect a teacher not only to give knowledge and skills, but also to show a positive attitude towards innovation. It is understood that presupposed that after acquiring a professional diploma and teaching license, a teacher continues to develop its professional skills.

One of the many roles of teachers is to personalize the teaching process. This means that a teacher should enable each student to activate their own existing competencies. In this way, the emotional attitude of students towards the material to be adopted is created. The basic precondition for starting and strengthening the motivation for learning is the attitude "I wish to learn". In practice, the teacher creates a situation in which each student activates his / her skills and motivates himself / herself to further improve them. In this situation, students are required to think, create and solve problems, in pairs, in a small group, in a larger group or alone. A student understands the interconnectedness of school subjects, as well as that knowledge he/she acquires and extends is a part of everyday life. Some of the forms of teaching that successfully activate, integrate and enhance the aforementioned skills are interdisciplinary teaching, project teaching, problem teaching, research work, peer learning, cooperative and collaborative learning.

It is the skills of co-operative and collaborative teaching that direct students to think in a collaborative way, as part of a group, i.e. one day as part of a team or department in a company. In jobs created in modern world and local labor markets, the necessary skills are critical thinking, creativity, cooperation, communication, information literacy, media literacy, technological literacy, flexibility, leadership, initiative, productivity, and social skills.

Although in the second plan, traditional teaching undoubtedly has qualities of its own. In it a student is the subject, while in an active classroom the student is the object. Given that a student can have both roles in the teaching process, as necessary, the teacher should strive for diversity in creating and managing the process and allocate the student an appropriate role. All this happens with the purpose of achieving learning outcomes, i.e. for acquiring and perfecting knowledge and competencies. This implies a combination of methodical approaches. The position of teachers in the modern teaching process is changing - it is now the person who monitors, directs students to cooperation, encourages qualitative argumentation, and helps in building a positive process of self-evaluation of students. The student is now able at all times to self-evaluate its contribution to a higher goal, to assess its knowledge and skills, to somehow execute auto-correction, i.e. to achieve an academically high-quality relationship of reciprocity with the teacher. Relations student-student, student-teacher, teacher-teacher have now become equally important, so interaction is the key to success.

II. Problem-Based Teaching

An attempt to try and achieve the aforementioned in practice was made in the primary school 'Rade Drainac' in Belgrade in January 2019. The teacher of technical education combined fifth- and eighth-grade students as well as teaching methods with the aim of creating a simple electric coffee device. The necessary preconditions – the necessary equipment, an enthusiastic teacher and willing students – were met beforehand. 'The necessary equipment' is minimal for this situation – an overhead projector, whiteboard, a laptop, and some tools – a wire, a soldering iron and some cables. Several basic components were obtained by dismantling the existing devices in the school itself: motor, switch, LEDs, conductors, mixer, charger, and a plastic case improvised from a plastic pipe. 'Enthusiastic' in this context is the teacher who is well aware that students are the most important 'raw material' and that she is the one modifies them. The very fact that one person can affect many students at the time, and that each moment may matter someday, creates a constant professional need for improvement, both of herself and of her students. 'The willing students' are the kinesthetic learners, the ones who have enjoyed making mud cookie and playing with building bricks, but who now also enjoy the element of adulthood, being important and appreciated by the teacher.

One of the topics in the fifth grade is Recycling, and programming and Arduin is also taught, which created an ideal opportunity to connect those with the topic of Electric household appliances.

The sensitivity of electronic components, their low cost and a wide range of devices and hardware are also reflected in their quality, which all has a large impact on the amount of electronic waste. The inability to dispose of or recycle this type of waste is a serious environmental problem. The idea was to dismantle devices the repair of which is not cost-effective but which contain fully functional components, to do that in an adequate way and to use them to create new and functional devices. Students get ideas, the teacher is there to direct.

The scene being set, the lesson begins. A few 8-th grade students had already filmed a video in which they talk about the school subject, what they like about it, what they enjoy doing and how they deal with the challenges the teacher introduces to students. They also explain how students work best as a group, when they have to come up with a specific tangible product of their work. They put additional effort to interview their fellow students and come to conclusions about how a group should function during the lesson. Their primary audience is their peers. From the methodological point of view, the aim of this activity is to set the tone to the lesson, to make an introduction to the topic, to activate the existing knowledge and memory, to review what they already know so that they can apply that knowledge to the forthcoming tasks. Also, the principle of starting from the known area, heading towards the unknown, is applied here. The filming and editing took seven days. During this period, the 14-year-olds had to work as a team. What about using and improving the necessary skills? Critical thinking – what to talk about, what is appropriate and selection of topics. Creativity – writing the script, the angle of filming, editing. Cooperation – students help each other out and allocate roles. Communication – agreeing, disagreeing, negotiating during the process. Information literacy – what information is relevant for the lesson. Media literacy – how to make and edit the film. Technological literacy – the equipment and editing programs they need. Flexibility – arranging the time to get together and do the tasks. Leadership – how to motivate others and encourage them to implement and finish the tasks. Initiative – motivation to complete the tasks, sharing ideas and giving suggestions. Productivity – how to edit the film so that it fits the introductory part of the lesson. Social skills – how to work as a team and overcome inevitable difficulties. The filming seems to be a simple task, but it obviously involves all the necessary skills. The teacher is there to help, check and monitor, if needed. The independence of the students turned out to be at an exquisitely high level, which was not such a great surprise to the teacher as it was for the students themselves. This triggers the intrinsic motivation, so much needed for successful academic achievement. The relation student – student is improved during the filming, and the relation teacher – student in the introductory phase of the lesson. A short 5-minute discussion starts, led by the teacher, with the aim of reminding them of the working rules and unifying the impressions of students coming from different grades, thus trying to set off the feeling of mutuality and cohesion. The teacher's non-imposing and natural leadership improves the effectiveness of the group. During the discussion, the teacher activates the knowledge which the students already possess, by using the technique of horizontal and vertical connection of learning materials. The 5^{th}-graders have already studied in this same subject the Arduino interface, the importance of recycling and how to connect the components of an electrical circuit. The 8^{th}-graders now have the opportunity to apply their physics knowledge. They calculate the motor power needed for the device to mix the coffee of the quality they wish to achieve. They apply the Ohm's Law to define the electrical resistivity and the necessary voltage for the device to be functional. The led diodes are the signal component which shows that the device is with voltage. Besides having applied the appropriate knowledge of this and the other relevant school subject with the guidance of the teacher, the students conclude with great satisfaction what the small lamps on their house appliances really indicate and what the amount of vats on their vacuum cleaner or kitchen mixer stands for. By implementing the inductive method in an unobtrusive manner, the teacher continues to empower their relation to the learning matter, which makes their wish to learn even stronger. It can be concluded that the right choice of teaching methods means that half the job has already been done for the teacher. In this introductory part of the lesson the students have already achieved the 'working temperature' and now they can deal with some concrete tasks.

After the discussion, the teacher divides students into five groups according to their skills. This way the class works collaboratively. Each group has its own task. They work like a mechanism, where each part has its specific role but the parts are interdependent and the whole would not work if one part fails or is excused. Every part is equally needed. The younger and older students work together. The element of peer learning is introduced now. It is very much needed here, because the task involves theoretical knowledge as much as skill. Technical education is a subject new to the fifth-graders. They are neat, precise and interested in finding out new things as much as a child can be. The older students know how to be practical, expedient and organized. One would think that a teacher is not needed in this phase. This is when she works from the background, monitors the process, notes down what she has heard and noticed in students' talk and behavior. To a layman, it would seem as if she was having a rest. This is one of the good things of the profession – a teacher works round the clock, even when it appears that she doesn't. Again, the relation student – student is in its high prime in this phase.

Now each working table has five students. Each group has to create one part of the simple device, which is to be attached to the other parts, and thus finally form the coffee device. Group one comprises of students who are good in aesthetics. These children like precision; they are creative and possess extraordinary production skills. The materials used were metal and plastic, and their colors were sophisticated black and grey. The mission of the second group was a complicated one – they had several ready-made parts and their task was to make a pump. The most skilled and dexterous students worked on this. The third group chose the appropriate cables for conductors and then they had to weld them, as well as to adjust the mixers. These students were the ones with the strongest theoretical knowledge in electronics. Another group of five students excellent in theory had to set the buttons on appropriate places. Given that there are buttons which define the quantity of water, device operations like crushing coffee beans, rotating the mixer and pouring milk, this was not an easy task at all. The fifth group had the task to put all the parts together into a functional working device. The students of this group were the most skillful and responsible ones. While the other four groups worked, they walked around the classroom, monitored what they were working on and reminded them to be cautious and to implement the safety measures. This group managed to give sense to the work of all other groups, because they were the ones who joined the separate parts and made a real coffee device, like the ones which can be bought in hardware stores. Let's analyze the necessary skills in this phase of the lesson again: critical thinking – where should an element be put and why; creativity –

implementation of ideas; cooperation – working together to create one product; communication – giving suggestions, discussing, negotiating, politeness, respectfulness; information literacy – the necessary theoretical knowledge; media literacy – how a real coffee device looks like and what it does; technological literacy – what cables, materials and wires do to make the device work; flexibility – readiness to back up and accept others' ideas; leadership – persuasion and directing the members to stay on track and to finish in due time; initiative – giving suggestions and ideas; productivity – contributing to the group's work; social skills – helping the younger ones, respecting the older ones, listening skills, tolerance.

Again, it seems to be an easy task to divide students in groups and just monitor their work. However, as said earlier, the teacher is the scenarist of the learning situation. In this example, she knows her students well. She knows their skills and strengths well enough to put them in teams which will each contribute to the final product. She is like a coach here. On order to be able to do this, a teacher has to be interested in getting to know and assessing students' skills. When they do the task correctly, she realizes that she has been right. This in itself boosts her motivation. The students are satisfied with the final result and the feeling of contributing to the team to do the right thing boosts their motivation. The basic element behind this kind of intrinsic motivation is emotion, the feeling of belonging to a group and the feeling of success. The relation teacher – student is getting stronger, without direct influence, without giving speeches or ineffective explanations.

Smiles on everyone's faces. A round of applause when the coffee device is put together. But, the moment of the final test is coming – will it actually work? There is a sudden silence as the deputy headmaster pours her coffee. She sips, sighs and smiles. 'Just like the one from a café', she says. A round of applause again. The device really works! Now all the adults guests in the classroom wish to try the coffee and the students handle the device with great satisfaction. The teacher congratulates them, and, as she finishes her drink, she asks for their attention and reassumes her role.

By using the method of guided discussion, her role now is to activate self-assessment of students. Of course they liked setting up the device, but they are capable of a deeper insight. How did they feel? How did they communicate to each other? Who was the natural leader in each group? Why did the others listen to that person? How did they decide what to do next? How did they show respect for other's ideas? She also uses her notes and reveals what she has heard and noticed during their work. She interprets their behavior and guides them to come to conclusions what they could have done better and what they should implement in their future work, in this subject as well as in life, generally. She encourages them to criticize themselves so that they would perform better in the future. Others learn from individual examples, too. Self-evaluation, self-correction, learner autonomy. Here, in the final stage of the lesson, the relation teacher-student is important again.

The colleagues teaching the same subject were also present in the classroom. After the lesson, a professional discussion is conducted. The idea seems applicable and knowledge is transferred to other interested teachers. The relation teacher-teacher is strengthened. Mission completed.

III. Conclusion

"When one puts a lot of effort into something, the greatest and best reward is for that to go well and to be praised. The meaning of human psychology is in work. When one sees that the work is approved and encouraged, there is no better or more fulfilling emotion. That's what I'm trying to pass on to my students. Technical education can help them in some aspects of life, but it is not as important as what we had today. Organization, creativity, readiness, teamwork. None of this would have been possible if we did not have the will. But we did have it, and look where it took us. We made movies, we made a coffee device, and we wrapped it all that into an interesting and educational program. I am very proud of my students, and I would be as much as proud if they failed to make the device in the end, because they were dedicated to the cause to the very end, without giving up. I also hope that this will also serve as an inspiration for other teachers and students to organize something similar in their lessons. Team work develops the creativity in children. The entertainment in school is unjustifiably neglected so the students perceive the school as something they do not enjoy, instead of rejoicing to be in it. Knowledge and reading is associated with the school and the school to something boring and then they lose their desire to learn, to advance. That is why I am delighted to see how much they devoted themselves to this project and that at the same time they enjoyed preparing it and bringing it to life." (the teacher's words)

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Focusing Software Engineering Education on Composability and Comprehensibility

Cs. Szabó*, V. Zsók**, E. Somova***
*Technical University of Kosice, Faculty of Electrical Engineering and Informatics, Department of Computers and Informatics, Kosice, Slovakia
** Eötvös Loránd University/Faculty of Informatics, Department of Programming Languages and Compilers, Budapest, Hungary
*** Plovdivski Universitet Paisiy Hilendarski, Computer Science Department, Plovdiv, Bulgaria
csaba.szabo@tuke.sk

Abstract – Composability and comprehensibility are two key concepts of component based software engineering (CBSE). Other CBSE key aspects are correctness and trust. In this paper, we present a new point of view on selected sections of our intellectual outputs to the ERASMUS+ Key Action 203 strategic partnership project No. 2017-1-SK01-KA203-035402. Our presented work in CBSE education relies on trust of students into the correctness of the components used during software composition and beliefs in the correctness of component documentation in evolutionary extension of an existing CBSE project. We can conclude that the more experienced developer the students become the lower is the trust into rarely used components, while many of them become blind to common mistakes of frequently used components. The level of experience in our case is mainly rising due software testing tasks and personal practical experience gained at software companies. Some influence of university subjects can be also identified, but the effect of these has to be increased in the future to produce better skilled software engineers.

This paper is part of dissemination of results of the Erasmus+ Key Action 2 (Strategic partnership for higher education) project No. 2017-1-SK01-KA203-035402: “Focusing Education on Composability, Comprehensibility and Correctness of Working Software”.

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I. Introduction

The main objective of the project No. 2017-1-SK01-KA203-035402 is to train educators from selected universities in the field of functional programming (FP) and closely related areas of informatics that this trained university staff then will contribute to the increasing of the level of education at their home university. Partners train other partners in selected area of FP by sharing their research results and using their (specific) teaching experience and methods. We expect novel knowledge to be taught in all theoretical levels.

Events and trainings of our project are as follows:

a) First teacher training (Amsterdam, Dec 2017), a short-term joint staff training event

b) The three “Co” winter school (Košice, Jan 2018), an intensive programme for higher education learners and teaching staff

c) Second teacher training (Nijmegen, Oct 2018), a short-term joint staff training event

d) 4COWS conference in the frame of MIPRO (Opatija, May 2019), a results’ multiplier event

e) CEFP summer school (Budapest, Jun 2019), an intensive programme for higher education learners and teaching staff

f) 3CO Workshop (Budapest, Aug 2019), a results’ multiplier event

Our partnership consists of 9 partner universities from 7 European countries:

a) Stichting Katholieke Universiteit Nijmegen, NL

b) Universitatea Babes Bolyai, Cluj-Napoca, RO

c) Plovdivski Universitet Paisiy Hilendarski, BG

d) Technical University of Kosice, SK

e) Eotvos Lorand University, Budapest, HU

f) Universidade do Minho, Braga, PT

g) Universidade de Coimbra, PT

h) Sveuciliste u Rijeci - Tehnicki Fakultet, HR

i) Universiteit van Amsterdam, NL

With the above type of projects, so-called Intellectual outputs are to be created to specific topics to improve a selected field or generic knowledge. An intellectual output is usually a single document or a set of documents aimed to be used by the members of the partnership to reach project goals and also aimed to be useful to a broader audience outside of the partnership. In our case, the targeted domain is Higher education (HE) in the field of Informatics, Computer science, Software engineering and related fields. We target both learners and educators, as this is the minimal and optimal layout in HE - no subset is relevant enough.

Component-based software engineering (CBSE) is the field of software engineering [10] that is focusing on definition, usage and re-use of components. It is the classical implementation of the theory of object-oriented design and development of software. Our presented work in CBSE education relies on trust of students into the correctness of the components used during software composition and beliefs in the correctness of component documentation in evolutionary extension [5] [6] of an existing CBSE project.

Our research interests are in observing and evaluation of selected sections of our intellectual outputs:

(RQ1) How much do current generation students require comprehensibility and composability in teaching examples?

Our hypothesis is that they require and would ask for missing details.

(RQ2) Do more experienced developers trust more on components used in CBSE? I.e. does the trust required in CBSE grow by experience?

Our second hypothesis could be expressed as "developers only trust a component that comes with a proof of correctness".

The structure of the paper is as follows. First, we describe the intellectual outputs in detail focusing on their content and designated audience. Next, we analyse these documents from the different points of view given by the above questions. Later, before concluding our work and pointing out several improvement possibilities on the analysed content, we discuss our observations taken at the first semi-open presentations of them.

II. Project Intellectual Outputs

The mentioned project has four Intellectual outputs numbered O1 upto O4. Each of them is connected to a specific training event or school.

A. O1

The first intellectual output is the The three "Co" winter school material. The covered topics include:

1) Acquisition of Natural Language by Machines
2) Static Code Analysis with CodeChecker
3) Programming in Management and Orchestration of Virtualised Network Resources
4) Cloud Computing and Functional Programming in Education
5) Modern type-safe embedding of attribute grammars
6) How Green Is Your Process? [8] [9]
7) Functional Programming of Devices
8) Code Comprehension with CodeCompass
9) Functional Programming Skeletons for High-Performance Computing

The O1 is targeting learners and teachers as well.

B. O2

The second intellectual output is targeting teachers only. It aims to include teaching practice advices along with content that applies novel research results. The covered topics can be found below:

1) Interactive Approach to Coloured Petri Nets Teaching [4]
2) User-centric Cloud Computing in Education
3) Towards an Engineering Discipline for Green Software [2]
4) Energy Efficiency Measurements During Software Testing [7]
5) Teaching Task Oriented Programming [3]
6) CodeCompass: an Extensible Comprehension Framework [1]

C. O3

The third intellectual output is specific in the way that this one is focusing on a single main topic. This topic is Task oriented programming of IoT devices. Another speciality in O3 is that it is more practical. That means that the majority of the content is being explained by examples, which ones can be also enjoyed by the learner and staff members by a simulation engine used. This interactivity offers a different perspective to the content of the material. On the other hand-side, O3 is related to a teacher training.

D. O4

The last intellectual output is related to a larger event - an intensive programme for higher education learners and teaching staff. Its size is also comparable to the size of O1:

1) Visual Prototyping using Task Oriented Programming
2) Task Oriented Programming for the Internet of Things
3) Paint your Programs Green - On the Energy Efficiency of Data Structure Implementations
4) Green Software in an Engineering Course
5) Software Application Energy Profiling for Java Projects
6) Development of Correct Software with B-Method
7) Programming of Advanced Management and Orchestration of Virtualised Network Resources - Selection of Case Studies
8) Code Comprehension with Advanced Tool Support
9) Functional Array Programming with Single Assignment C: Opportunities and Challenges
10) Balanced Distributed Computation Patterns
11) Computer Systems for AI-inspired Cloud: Theory & Lab

The last listed topic is one outside of the partnership presented at the summer school by Jong-Won Kim (Gwangju Institute of Science and Technology, KR).

III. Analysis

All parts of the intellectual outputs focus on application of novel research results. Some present more theory while others are almost purely practical. Table 1 presents identified relations of parts of intellectual outputs to topics of our interest.

As shown in Table 1, all intellectual outputs are aimed to be related to all generic topics. Topics of O1 and O3 are equally distributed over comprehensibility [1], composability and correctness. In the case of O2 and O4, this distribution changes in a disadvantage for correctness.

Table 1: Relations of intellectual output topics to the three "Co"

Comprehensibility	O1.1-2, O1.6-8, O2.3-6, O3.*, O4.3-5, O4.8
Composability	O1.3-5, O1.7, O1.9, O2.2, O2.4-6, O3.*, O4.1-2, O4.7, O4.10-11
Correctness	O1.4-5, O1.7, O1.9, O2.1, O2.5, O3.*, O4.6, O4.9

Another property we analysed was trust in components used in the presentations and material. Many presented topics were domain specific. Thus, proofs of techniques used were also valid for a limited scope. In many cases were used components evaluated only experimentally. Trust in used components was high. It could be caused by the fact, that known limitations were presented and these limitations were not penetrated by the presented examples. All materials apply the safety principle when using components and composition.

As the targeted audience is not limited to users of a specific operating system or programmers in a selected programming language, it is important to evaluate whether the content of any intellectual output is limiting this targeted audience in size and diversity.

With O1, O2 and O4, we can easily conclude that there is no limiting factor on the audience. O3 is more complicated being a single-topic material. There is a kind of limitation but considering its targeted audience, this limitation is in offering a novel methodology and tools of IoT device programming. Thus, our outcome of this part of the analysis is that there is no valuable limitation. It is more a presentation of a new possibility to deal with known problems in a FP way. Highly focusing on composability with a required level of trust.

We also observed usage of the material. These observations are included in this analysis section in the following paragraphs.

It might be caused by the different explanation styles of our authors, but there is an observable difference between the presented parts of intellectual outputs. Targeted audience is also very colourful. Student personality might be different as well as their cultural background. We observed general truths about teachers and staff members asking more on details, pointing out errors. Learner behaviour could have been not generalised that way.

There were three strongly different groups. Members of the first one were the typical scouts. They had questions when they reached limits of own knowledge and skills, otherwise they were satisfied with their exercise results. They found alternative solutions when they were unable to directly apply the intellectual output. Questions from students of this group were marginally related to the specific output, but were strictly focused on their own often alternative solution/problem.

The second group of students had a strong detective/investigator kind of personality. We observed that by the fact that they were asking for details like teachers did. Besides that, a level of personal experience of these students was measurable. This group had members whom we could also assign to a subset of students based on their affiliation to university. Asking is very probably strongly influenced by cultural background.

The very small rest of the students had no questions nor remarks. They tried the most basic examples or did not present any engagement in some of the topics. They remained silent.

Despite known limitations of components, many of them are used in the intellectual outputs. There is no main aim to create a perfect component at all. Our outputs also use errors to teach. Failure is used as a comprehension artefact. One of the critical properties of components used in CBSE is their compatibility and another one is elimination of side effects of composition. While FP provides languages of composition with almost no side-effects, other covered programming languages require additional testing in CBSE. Many school attendees were experienced programmers and were aware of risks of composition. When there were less details of an example defined, these students used their frequently used components, project architecture etc. Experience was observed as a very strong factor.

Students played blind in the meaning that they followed the examples even they knew that they will fail several times until success. This is a common procedure in teaching programming that is known by our students. Testing own capabilities of program or task comprehension was a challenge for teachers as well. Many times, comprehension trials turned into test-usage of components suggested by the authors of the intellectual outputs. Only a few of the participants tried out presented alternatives. The paradox is that this was more influenced by knowing the alternative than by the programming abilities.

IV. Discussion

There are two research questions to answer in our paper. Regarding RQ1, we used physical observation and recording at presentation and usage of the presented intellectual outputs. According to the attendees' responses and behaviour, we can identify three groups with different behaviour. Existence of these differences prohibits us to fully evaluate this question. The need of details provided is proven by the existence of the group asking for missing material or pointing out errors in specific parts of it. On the other hand-side, we cannot prove that all participants would really ask for a missing detail, as some of them might consider errors as an aim of the author. It is not true in general that all participants would ask for more details. Some of them will start to search for them independently or repair the found errors silently just for themselves. RQ1 hypothesis does not hold.

Looking up the second research question, the hypothesis related to it holds in the case of FP as everything comes with a proof. But, as we wrote earlier, many components are used despite their known strong limitation. This is because software is not always considered to be acceptable only if it is correct. Some limitations of components might be also hidden after their integration into a bigger infrastructure. Since comprehension of components is much better when coming documented, the requirement on a correctness proof is high as a good proof also explains the component.

The role of participant experience turned out during our observations to effect the usage of components differently as we assumed with RQ2. The observed behaviour of experienced programmers was focusing on usage of known components despite their limitations over the usage of any new component prototype. This trend was measured based on individual questions to participants.

V. Conclusion

In this paper, we introduced the intellectual outputs of the Erasmus+ Key Action 2 (Strategic partnership for higher education) project No. 2017-1-SK01-KA203-035402: "Focusing Education on Composability, Comprehensibility and Correctness of Working Software". We also analysed these outputs from selected points of view to find answers to our usage-related questions.

The first hypothesis that the students will ask for more details to better comprehend software components was not proved. The behaviour of the majority was more focused on surviving the classes, only a few students showed initiative and asked. This situation in HE should be changed to support student questions.

Our second hypothesis in the trust in components and its growth by growing experience did also not prove. Experience taught students to select between known and unknown, but the will to experimentally learn new and different solutions was very low. It is also true that there was a better grade the only motivation.

When asking on the source of knowledge, indeed, students selected company work experience and own experience in the top places, while the possibility learnt at the university was much lower. Personal experience with these kind of answers shows that about the half of these students only forgot to mention that the first meeting with used technology and known solutions was at a HE institute.

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Education in Cyber-Physics Engineering

L. Cveticanin
Faculty of Technical Sciences, Novi Sad, Republic of Serbia
cveticanin@uns.ac.rs

Abstract – In this paper the modern concept of education program for mechanical engineers according to the strategy INDUSTRY 4.0 which requires introducing of the cyber-physic systems is presented. An example of education program developed on the well-known university in the world is shown. Mechanical engineers educated in this program are able to form cyber-physical systems in design, construction and production technologies.

I. Introduction

We are living and working in the period of the fourth industrial revolution (Figure 1) which includes digitalization in all spheres of life. Today, digitalization is the necessary part of the everyday life, which is the key component in all areas of competivity in technics, economy and social activity.

The first industry revolution started in 1784 when the first mechanical Razboj was constructed. It lasted until the 18th century. In the meantime a significant number of mechanical devices driven with water and steam were constructed.

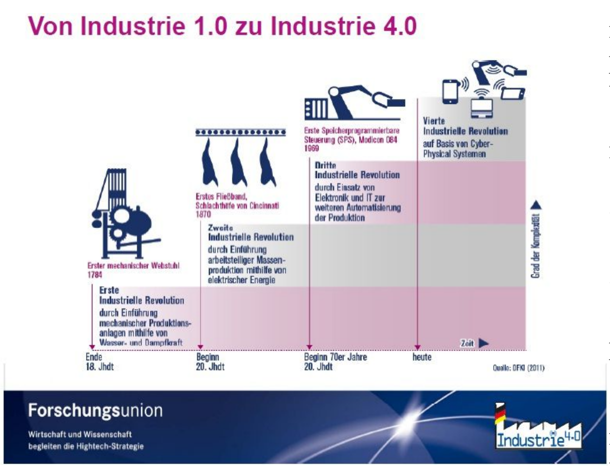

Figure 1. Industrial revolutions during centuries. [1]

In 1870 the first montage trace for a factory in Cincinnati (USA) was made. Since that time the second industry revolution is considered. It was finished at the beginning of the 20th century. At that time the application of the electric current was widely spread.

In 1969 the first programming logic controller (SPS) MODICON 084 was created. This year is considered as the main industry revolution. Since that year the third industrial revolution is calculated. Starting with 1970 in the 20th century the electronics and IT for higher level of automatic production is developed.

The fourth industrial revolution started by introduction of the strategy INDUSTRY 4.0. It is based on cyber-physical systems (CPS).

This revolution requires new type of engineers, i.e., CPS engineers who would be experts in connecting of the cybernetic (virtual) and physical world i.e., an expert in cyber and physical systems.

II. Strategy 'Industry 4.0'

Nowadays, one of the most important problem of the world is how the people to survive. Namely, the investigation show that up to 2050 more than 80 procent of world's population would live in megapolises. To survive this population migration, strong preparation and modification of the whole world is necessary. The strategy 'Industry 4.0' has the aim to help in overcome this problem. The strategy of development is based on the requirement for integration and connection of production, information and communication technologies. Internet, Of-Things technologies, artificial intelligence, robots, production mechatronics, cyber-physical production systems are the future new technologies for thechnical development and industrialization..

Industry 4.0 requires the digital transformation in companies in designing, producing, marketing, control, selling. It is necessary to inovate the producing process by digitalization, wide application of robots, intelligent automatization and internet technology. It is proposed that the realization of the program Insustry 4.0 would give the quantitative jump in integration of the main properties of the traditional information delacis and real physical systems. However, it is impossible to imagine how the inteligent factory will look-like in the future. Scientists from the whole world and for all scientific areas are asked to give reply on the requirement of the strategy of the Industry 4.0.

III. CYBER – PHYSICAL SYSTEMS

The term 'Cyber – Physical System' (CPS) is obtained due to connection of the virtual i.e. cybernetic system and of the physical one. Two independent systems, information technology and telecommunication, at on one side, and the production and producing devices, at the other side, are interacted. Thus, CPS is such a mechanism which controls and monitors the physical systems with a computer algorithm which is strongly connected with Internet. In CPS systems the physical and software components are strongly connected. Examples of CPS include the robot systems, automatic piloting of planes, processes of system control, autonomous automobile systems, etc.

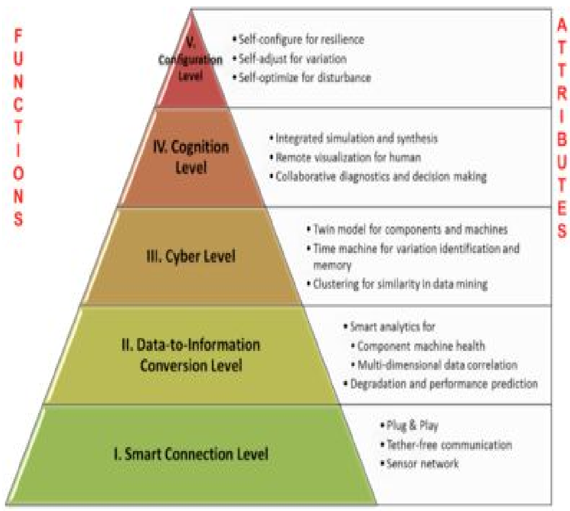

Figure 2. 5C architecture. [1]

CPS requires interdisciplinary consideration: connection between theoretic cybernetics and mechatronics at one side with design and knowledge of the process at the other side. Process control is usually done with in-built systems, where the main attention is given to computer elements but the connection between computer and physical elements is neglected. Namely, CPS is a combination and coordination between computer and physical elements. The first CPS are found in aeronautics, automatics, chemical processes, civil infrastructure, energetics, health protection, transportation, etc.

A. 5C architecture for CPS

Design and positioning of the cyber – physical production system may be realized based on 5C architecture (Figure 2): connection, conversion, cyber, cognition and configuration. At the level "Connection" the design is made on the principle of self-bounding. At the level "Conversion", data for self-connection obtained by sensors are compared with critical values, and based on the difference between data the prediction of the machine properties is possible, In "Cyber" level, all machines design their own "twilling" using the measured data and give the characteristics of the machine based on methodology "Time-Machine". The formed "twilling" in cyber space may give the self-comparison and data are applied for future synthesis of the system. In "Cognition" level, output data of the self-evaluation given with "infographic" with the aim to give the content and context for future application. In "Configuration" level, machine or producing system may be formed based on the priority and criteria of risk for safety work.

IV. EXPLANATION OF MECHANICAL ENGINEERING EDUCATION IN CPS

During the intensive technic development, when the fourth period of the industrial revolution promoted with strategy Industry 4.0 is evident, it is necessary to modify the plans and programs of mechanical engineering education to the requirements of the recent time. Special aim is to introduce the newly developed CPS with all of their specificities due to the significant difference in various applications in different engineering disciplines as for example, the sofware engineering and mechanical engineering. However, in the industry where the new products have to be shortly introduced, engineers of all types have to use all systems at the same level of knowledge, independently on their basic education: sofware or specific engineering. Unfortunately, there is not a common vocabulary in practice which is the same for all applicable disciplines in CPS.

The aim of the education is to give certain knowledge to mechanical engineers in digitalization which can be applied in design, construction and production, to apply recent methods for technical documentation for technology and realization of the product, and so on. Mechanical engineers have to be able to apply modern technologies in engineering process, but also to have the possibility to learn the new scientific knowledges.

According to the aim, new educaiton programms for mechanical enginners are developed all over the world.

In [2] the recommended titles of courses for 4-year bachelor studies for mechanical engineers directed toward CPS technology are given. All courses are put in four groups: Basic courses (9), Courses in mechanical engineering (13), Courses in CPS (5) and Optional courses connected with CPS.

Basic courses (9 courses)

- Mathematics I
- Mathematics II
- Vector calculation
- Differential equations
- Linear Algebra
- Probability and Statistics
- Physics I (Optics and Relativistic Mechanics)
- Physics II (Electrotechnics and Magnetism)
- Chemistry

Courses in mechanical engineering (13 courses)

- Introduction in engineering graphics and design
- Mechanics I: Statics
- Mechanics II: Dynamics
- Strength of material
- Fluid mechanics
- Thermodynamics
- System dynamics
- Engineering materials
- Experimental technics and Laboratory
- Systems in mechanical engineering and Laboratory
- Heat transfer
- Cutting materials
- Economics in engineering

Courses in CPS (5 courses)

- Introduction to computing and programming
- Electric circuits and Electronics
- Computation methods in engineering
- Instruments and Electronics - Laboratory
- Capstone design (with CPS-focused projects)

Optional courses connected with CPS

- Modelling and control of motion
- Microprocessors for control of the producing systems
- Robotics
- Designing according to Bio-Systems
- Design Across Disciplines
- Bio-medical instruments
- Mechatronics
- Net of sensors

The idea of double model is based on the connection between physical systems with virtual ones by using intelligent systems,

V. Recommendation for including CPS in the existing programms

One of the strategy of development of the Republic of Serbia is to establish small- and middle-size companies, as grants for further development and economic prosperity of the country. These small companies have to be connected with middle one and have to be their services. Thus, requirement for education of mechanical engineers who would have good knowledge in problems of mechanical engineering in general is or special interest. These engineers would know the new technologies but also would be able to give new solutions and machines for all spheres of industry.

At the moment, Faculty of Technical Sciences educates mechanical engineers (of bachelor and master degree) which are highly specialized for some areas: Producing mechanical engineering – with two directions – Recent technologies of material forming, Recent technologies for forming plastic materialss, Software for mechanical engineering, Computational technology, Accurate engineering, then Mechanisation and constructing mechanical engineering – directions of Mechanical constructions, transport systems and logistics, Agricultural and alimentation mechanical engineering, Energetics and process technics with directions: Process technics, Thermoenergetics, Hydropneumatics, Gas and oil technics and Control of energertic flow. Faculty of technical sciencies educates a special group of mechanical engineers for Technical Mecahnics and Design in Technics. All the programs at mechanical engineering have to be modernized by including the strategy Industry 4.0 and including elements which are connected with CPS. It is recommended to modify the program according to those already applied on other universities in Europa and abroad.

Concept of the education plan and program has not to be changed: the priority have to be given to the basic courses in mechanical engineering, but some modification is necessary according to the new tendency in tehnics and technology.

Recently, when the production is directed toward making parts with 3D printer, when the nanotechnology is widely applied, when not only macro but micro mechanical systems are produced, when the information technologies are included as the results of the 3. industrial revolution in communications between persons, it is necessary to modernize the plan and programm to give the real view of engineering for future generation of students of engineering. However, all of the aforementioned is based on the theoretical statements of the basic sciences whose knowledge is necessary for mechanical engineers (physics, mathematics, mechanics, fluid mechanics, thermodynamics, automatic control and basics of programming and computing techniques). Students, which are educated according this plan, has to obtain general knowledge in mechanical engineering i.e., in producing mechanical engineering, designing, mechanization and thermo-technics. The basic courses in mechanical engineering: engineering materials, design and construction, mechanical elements and production technologies have to be extended with the basic results in investigation in CPS. Applying the knowledge in mechanics and control, the student is able to understand the theory of mechanism, robotics and mechatronics. Using the principles of mechanics of continuum, fluid mechanics and thermodynamics students would learn the courses in hydro-pneumatic systems, but also dynamics of pumps and fans with CPS control CPS. The study program has to include courses for environmental protection and elimination of the noise and vibration. Using the knowledge in Vibration Theory, which would be basically studied in this program, has to available the future engineers to be experts in vibrodiagnostics of machines and devices. In addition, by superposition of the knowledge in programming and information technology, students would be educated in cyber-physical systems (CPS) which give the connection, control and management on the relation man-machine.

The so conceptuilezed education program would give the basic knowledge in general mechanical engineering for engineers who would work in companies which are not specified to certain programs and are not able to establish high number of of experts in the field. Mechanical engineers with this education would have the knowledge in all areas of mechanical engineering from design, constructing and producing but also exploatation of machines, new technologies and modern control methods. Mechanical engineer would be adequate for individual work in general mechanical engineering.

Education plan and program has to be more recently and the application of the new education devices and technical apparateus is suggested. The inovation in the educaion is highly motivated and supported by the Ministry of science and tehcnical development of Serbia. Thus, this Ministry gives the financial support for the project: Mech-in-NS:

- Multimedial and interactive education and study of the Engineering Mechanics, schoolyear 2017-2018.
- Inovation of a group of subjects in engineering mechanics by using the IT technology, creation of multimedial content and collaboration with industry, 2018-2019.

which avalable the on-line education on the cite http://www.mech-in-ns.ftn.uns.ac.rs/#.

VI. Conclusion

Plans and programms for education of mechanical engineers have to be improved and modernized by including the knowledge which are necessary for realization of the requirement of the new strategy Industry 4.0. It requires CPS to be studied and the already existing program and courses to be extended with new knowledge in CPS.

Acknowledgement

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Inclusive Education of Talented Students: Legal Aspects

I. Ninkov
Doctoral School, Obuda University, Budapest, Hungary
ivonakakas@yahoo.com

Abstract – Talented students are very important part for the prosperity of every society. There is the need for their high education which would increase their creativity and specific talent. The aim of this paper is to give suggestion how to develope a good education system for talented which will increase their knowledge and ability, but not to disturb their everyday life and education environment. The continental and Anglo - Saxon legal systems in education are considered. The systems are analyzed using the comparative scientific method. As the result it is concluded that the concept of inclusive education is one of the best for education of the talented students. However, it requires changes in the legal system of education.

I. Introduction

One of the most important human rights is the right of education. Thanks to this human right, we are able to understand the world around us, explain different phenomena and express our interests. In order to explain the synthagma ‘the right to education’ as precisely as possible, we need to take a look at Article 26 of the Declaration on Basic Human Rights [1], and Article 5 of the Convention against Discrimination in Education [2]. In the Declaration, it is clearly and concisely explained that education should be free, compulsory, and available to all, under equal conditions. Education should focus on the full personality development and strengthening the respect for human rights and fundamental freedoms [3].

In the widest sense, the principles of education rest on the idea that children should be provided with all resources necessary to fulfill their dreams [4]. Applying the logical interpretation, education should meet numerous and various needs students usually have.

When referring to giftedness, there are different theoretical perceptions and doubts on the term and concept itself. For example, Terman, as one of the pioneers in this field, considers students who rank within the top 1% on standard intelligence tests to fall under the ‘gifted’ category. This interpretation started to fall out of favor during the mid-20th century, when it was believed that the determination of intelligence, cannot be subordinated to standardized tests. Due to Marland [5] the gifted children are defined as those who perform well general mental ability and have also excellent special abilities in a certain academic field. According to Woods [6], gifted and talented children are defined as children who are distinguished from their peers by their general and/or special abilities. Gifted children are rare, while the adults’ ability to perceive giftedness is often pretty limited [7]. Pfeiffer [8] states that in a majority of cases, it is difficult to recognize gifted children. Namely, even when they are perceived as such, parents and teachers often do not know how to develop and improve the innate giftedness of the child in the best possible way. Giftedness and talent are continuous processes created as a result of the interaction of different factors, such as individual predispositions, one's ability to influence his/her own development, and the influence of upbringing [9].

At the first glance, it is quite easy to recognize giftedness in the fields of art, music and sports [10]. These catgories enjoy benefits of sports classes, arts and music schools, where these classes are organized. The alarming issue is that there are other gifted children who do not demonstrate these clearly visible talents, but who require an active and planned strategy for the emergence of their particular gifts. Often, educational support for gifted children is neglected by inertia, since it is considered that these children already differ from their peers, and additional stimulus is not necessary. Giftedness implies high degree of individual achievements in specific areas, in comparison to child’s peers.

According to all abovementioned, it is necessary to provide gifted children with full support up to the maximum when developing their capacities. The reason for this ground is that a tremendous advantage over others can easily be turned into a disadvantage, especially if the gifted children are not directed in the rights way.

Guided by the Continental and Anglo-Saxon Legal education systems for the gifted students and exploring the concept of inclusive education, mainly applied for the children with special needs, this study aims to give the new concept of inclusive education of the gifted students providing them with full and consistent support to the maximum while developing their capacities.

II. METHODOLOGY AND COMPARITON OF LEGAL REGULATIONS

Every country has its own educational policy and legal regulations of gifted children. In this section the comparative method, focused on Continental and Anglo-Saxon Legal systems, is applied. Based on similarities and differences observed through various legal systems it is possible to form and base the opinion on the legal aspects of inclusive education for gifted children.

In this paper we analyzed the legal framework of Continental legal systems in Balkan countries (Bosnia and Herzegovina, Croatia, Republic of Serbia) and some European countries (the Netherlands, Germany, Turkey, Austria, Hungary) and also of the Anglo-Saxon legal systems in United States of America and United Kingdom.

A. Continental legal systems

The Framework Law on Primary and Secondary Education in Bosnia and Herzegovina [11] has guidelines for the education of children with special needs and does not recognize gifted students as a category at the same time. Article 4 of the Framework Law stipulates that every child has the same right to access and equal opportunity to appropriate education without any discrimination.

The Law on Education in Elementary and Secondary School in the Republic of Croatia [12], recognizes gifted students. Schools are instructed by the Ministry of Education to monitor and encourage these students through additional assignments according to their preferences, abilities and interests.

According to the Law on the Foundations of the Education and Upbringing System of the Republic of Serbia [13], special attention is paid to work with gifted children. Thus, Article 3 of the aforementioned law claims that persons with exceptional abilities have the right to education and upbringing with the respect to their special educational and upbringing needs, in terms of special classes or special schools, in accordance with this and other specific laws. Furthermore, Article 56 provides the possibility of organizing individual programs for exceptional students, both at the elementary and secondary levels of education. In addition, according to the Law on the Basis of the system of education and training, the educational institution can adapt the school program to students who achieve outstanding results in the field of education, which includes adoption of an individual educational plan. This plan is a special act aimed to satisfy educational needs of the child or the student. It is endorsed by the pedagogical collegium of the institution, to the suggestion for the inclusive education, i.e., the team for providing the additional support to the children and students and consists of a teacher, professional associate, associate, parent or other legal representative. According to Article 76 of the Individual educational plan [14] the deepening and expanding content of educational activities of children with exceptional abilities is aimed.

Even in some aspects the western European countries have some advantages in comparison to other countries, it is not the case in education. For example, education in the Netherland relies on a concept of a "broad middle group" so there is no clear student selection: on the one hand, very ‘weak’, less capable, or struggling, and on the other hand, gifted, highly advanced or excellent student. Similar is the model in Greece where the national creed is: ‘Do not stand out’ and ‘Good is good enough’. In this way the mismatch between the gifted students and teachers, who themselves were not 'gifted students' back then in their early education process, is eliminated.

The Ministry of Education, Culture and Science of the Netherlands went an extra mile, overcoming the inclusion of gifted students and possibly gravitated towards positive discrimination in manner of segregation. To illustrate, the Ministry developed plans and measures, and founded schools with gifted educational profile and plan, and schools with the Leonardo concept (school-within-a-school).

In Germany the situation is quite different. There are two education models: the ‘accelerated learning’, which requires high ability of quick data processing, and the ‘extensive learning’ which requires a high ability of huge amount of data processing [15]. In addition, outside the school there are special associations and foundations for gifted children which is the new wave in reorganizing of the inclusive education. Some of the most important associations are: Bildung & Begabund and parents’ associations, as primary observers of gifted children. Such associations are: Deutsche Gesellschaft für das hochbegabte Kind, Hochbegabtenförderung e.V, and ‘Mensa’. Two of the most famous foundations are Karg-Stiftung für Hochbegabtenförderung – Karg and Stifterverband für die Deutsche Wissenschaft. In addition, there is the Deutschlandstipendium, and also the Cusanuswerk and Evangelisches Studienwerk

Villigst. One of the most famous foundation is Deutsches Schülerstipendium, which supports highly capable students from poor families. All of this gives us a conceptual model that could be adopted in different countries, beyond the framework of measures and action plans of the Government.

Keeping in mind that gifted children represent the largest source of the country's immaterial wealth [16] and that they are the basis of future development and will shape the future of the state, in Turkey an assembly, called Grand National Assembly of Turkey (TGNA), is formed as a working group focused to improve the status of gifted children. The gifted children receive adequate and timely support during their education.

To continue, as far back as in Austria in 1962, it was explicitly mentioned that the gifted should be provided with the adequate protection [17]. In 1970 the practice, that students who exhibited talent had the possibility to skip a grade, was introduced. Since 1990, the gifted were recognized as the special category, with all rights which belonged to children with learning difficulties or disabilities. In 1999, a special Austrian Center for Research and Support for the Gifted and Talented was established in order to support both gifted children and their parents and teachers.

If we take a look at the Hungarian educational system, we will see that gifted students receive excellent treatment and quite good starting point to develop their talents even further. This system recognizes gifted students as those who require special treatment [18]. What particularly stands out in the Hungarian Education Law [19] is the application of ‘enriched’ teaching, which comprises additional classes, custom assignments and various external competitions, while skipping classes or sharing classes with older students is a rarity. More and more teachers take part in trainings in gifted education on a daily basis, with the ultimate goal to train one teacher who specializes in gifted students per school to coordinate the work and progress of these students [20].

B. The Anglo-Saxon Legal System

Education of the gifted students in Unated States of America have been nurture in 1920th and 1930th [20]. According to National Association for Gifted Children during the 1970s the movement received support in the form of statutory regulations when the federal government dealt with gifted issues specifically and introduces the National Standards in Gifted and Talented Education. An extremely important legal act in this field is the so-called Javits’ law [21], named after Senator Jacob Javits for his role in promoting gifted education. The original 1988 law was revised in 1994 to create the opportunity for primary and secondary schools to meet the needs for educating gifted and talented students. Due to its importance, this law has been accompanied by numerous congressional activities, among which is the financing of the Javits program for gifted students. Although, in 2003 and 2006 an impressive $11.2 million and $9.6 million were allocated, scientific circles in the United States consider these figures as insufficient to educate and stimulate the gifted. Another very important legal act is the No Child Left Behind Act [22] which requires state schools financed from the federal budget to implement yearly standardized knowledge and skills tests among all students. This equalizes initial possibilities of gifted students, from middle and upper-class families with students from lower income families.

Moreover, the Department for Children, Schools and Families in the UK [23] has implemented series of measures aimed to support gifted education, including the National Program for Gifted and Talented Education, clearly defining that the program encompasses children and young people with one or more abilities developed far beyond their average age group. The United Kingdom went above and beyond when the Government established a national strategy and national standards in order to improve the education of gifted and talented children in schools. The Institution Quality Standard (IQS) is set up to make it easier for schools to plan gifted education, while the Classroom Quality Standard (CQS) is designed.

III. DISCUSSION

Comparing the legal instruments, applied in the United Kingdom and the United States with Anglo-Saxon Legal systems of education of gifted students, it is evident that they are very similar. In both of countries the gifted students are financially supported and are incorporated into special group of students learning the particular programs. The United States give the highest financial support for education of the gifted students. However, there is not an inclusive education for the students.

The countries with the Continental legal system have much higher differences. Thus, for example in Bosnia and Herzegovina, the gifted children are not recognized as a special group of students, while in Croatia these students are specially treated and the regulation is delegated to the Ministry of education.

Similar, in Austria, the Research Center for gifted students is established.

The Netherland was the first to introduce the concept of 'school-within-a-school' for gifted students. Special classes for gifted children were organized. Unfortunately, the idea collapsed due to the fact that there was no sufficient number of students as well as teachers. Although in Netherlands the idea was fantastic, but it had different outcome in practice. One of the most pronounced problems was that the teachers did not recognize the number of gifted students as critical. Government of the Netherlands, together with numerous scientific institutions, carried out series of projects from 2000 to 2010 in order to clearly define talents of gifted students. The gifted student was defined as someone with a natural ability that needs to be developed, directly depending on an exceptionally stimulating environment [24].

In Germany some associations and foundations outside the schools are founded to deal with gifted students, which are financially supported, but have nothing to do with the education in the official school system. In Turkey, however, a working group is formed to advance the gifted ones with adequate protection.

Hungary and Serbia developed very similar legal approaches for gifted students. Individual programs and individual educational plans can be intended. Unfortunately, the financial support is minimal and the realization of the system is impossible at the moment.

Finally, it is concluded that there is no a general legal regulation for education of the gifted. All countries give their own solution forming special schools. Unfortunately, these schools do not exist in all towns of the country.

To overcome the problem the model of inclusive education is suggested. This model is developed and applied for children with special need.

IV. INCLUSIVE EDUCATION

There are various concepts of the inclusive education. In USA the inclusive education is defined as the service for children with specal need with the aim to ensure their socialization [25]. Similar formulation is given by the Ministry of education in Turkey [26].

In the United Kingdom there are a few definitions given by various associations and institutes. In the lecal document of the Ministry of Education it is given that the 'inclusive education' includes children with severe disabilities into regular education [27]. The Center for Studies on Inclusive Education (CSIE), an organization promoting the growth of inclusive schools in the UK, sees that inclusion enables all students to fully participate in life and work, regardless of their needs; it is also a permanent process for removing the barrier to learning and participation for all children and young people. The Equity Group Association from Scotland believes that inclusive education recognizes that children have equal rights and equal value. This should be a fundamental starting point for education and social policy in modern society.

In the Netherlands, inclusive education is called 'the appropriate education' [28]. When it comes to the rights of the gifted, it is necessary to address the very current topic of inclusive education, which not only refers to education of children with disabilities as the inclusion into the regular educational system, but also to quality education for all children. Every democratic society firstly needs to emphasize tolerance as a basis to respecting diversity, in order to be able to implement and accept inclusive practice [29].

Namely, concept of inclusion requires a system after measure of children [30] but without discrimination [31]. Direct discrimination exists if a person, or a group of persons are due to his/her or their personal characteristics, in the same or similar situation, placed in a more unfavorable position, or could be placed in a more unfavorable position. Gifted students are not allowed to be placed in an unequal position compared to other students. Opening the door to inclusive education implies that regular education should be available to children, while the teaching staff has to adapt their mode of teaching to the individual needs of children. Inclusion means providing support to both employees and students, while the product of all of that is a community that encourages and respects their differences [32].

Bearing in mind that the education of the gifted, as well as their general status in the education system, is one of many burning issues, the legalization of the inclusive education of these students has to be done in the shortest time.

V. CONCLUSION

Based on the investigation it is concluded that the inclusive education, which is applied for children with specific need, has to be adopted in education of gifted students, too. Inclusive education has to include the specifity of abilities, talent and need of children. To realize this type of education, the legal regulation has to be changed.

Changes in education system requires preparing of teachers for the work. Teachers are educated through workshops, additional studies or trainings. Only the staff with high qualification is possible to improve the knowledge of gifted students for whome is expect to be the basic force in future society development.

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The Impact of Modern Technologies on IT Project Management

T. Zorić, V. Makitan
University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
tamara.zoric@tfzr.rs, vesna@tfzr.uns.ac.rs

Abstract – Information technology (IT) project management has an impact on the success rate of a project's realization, and its implementation really makes a difference. Furthermore, IT project management is constantly developing tools and methodologies, and is in line with the latest technologies. Latest technologies, such as Internet of Things, Cloud Computing, Artificial Intelligence, etc., have multiple effects. Organizations, institutions and companies are transforming themselves in order to adopt new technologies and improve their business. Regardless of its inertia, the educational system is also changing in order to include the latest technologies in its study programs and to answer the needs of modern market. IT project management improves its tools and techniques, and is changing as well.

The objective of this paper is to provide an overview of modern technologies that have a growing impact on the IT project management and, consequently, the success of IT projects, based on which, education curriculums could be modified and improved.

I. INTRODUCTION

Considering that IT project management is closely related to the use of various tools and technologies, the issue of the development of new technologies and their impact on changes in project management practice is becoming more and more interesting for the research community. Many organizations depend on their ability to take advantages of the potential of modern technologies. That is why there is a high demand for project managers with essential theoretical knowledge from the field of project management, as well as from the field of IT industry. One of the key challenges in education is to enable faster adaption of changes in information technologies. As one of the focuses of education should be on achieving professional competencies, additional research must be focused on the examination of modern IT trends. Such considerations have resulted in motivation for dealing with this topic. This paper is intended to provide an overview of modern technologies, in this case: Internet of Things, Cloud Computing and Artificial Intelligence, that, among others, have significant impact on the field of IT project management. Based on that, further research can be focused on the issue of improving education in this area.

II. IT PROJECT MANAGEMENT AND PROJECT MANAGERS' ROLE IN PROJECT SUCCESS

Project management could be applied to any type of a project, but often there is a need to adapt to specific needs of various specialized industries [1, 2, 3]. Such a case occurs in the field of information technologies, where it is often discussed that most of the conventional project management techniques cannot be applied to the management of IT projects. Information Technology Project Management is defined as a type of project management in which IT projects are planned, executed, monitored and controlled by a project team [4]. In comparison to other types of projects, e.g. manufacturing project, IT projects are considered to be short-term projects and projects with a great degree of uncertainty. The IT industry and IT projects are recognized by a higher failure rate in a project's realization [5].

Improvement of the success rate in project realization is a consequence of a greater project management practice, availability of better technologies and methodologies, and an increase in number of skilled managers with good knowledge support [6]. Project managers are expected to be the main leaders in the future development of project management practice [7], which is why the demand for good project managers continues to be high. They are expected to face new situations using various elements of modern technology. For that reason, organizations expect project managers to have appropriate skills and knowledge that follow modern trends, often referred to as a part of professional competence. It is considered that professional competence of a project manager has an impact on the choice of technologies, tools and techniques which are important for the successful project delivery [8].

In the field of information technology, it is considered that an ideal IT manager, in addition to all of his/her skills and knowledge, should have technical knowledge as well. Although this knowledge is no longer considered to be crucial for achieving project success, it is still considered that project managers need to understand complex issues and compromises of new technologies [9]. According to [10], the main reason for dissatisfaction with the IT project is lack of project manager's knowledge in the field of information technology. This dissatisfaction occurs due to the fact that success or failure of IT projects depends on the exact technical and management support of project managers. New technologies can provide great benefits for a project manager, but they can also create many problems if the manager is not familiar with the technologies or if the technologies are in conflict with the manager's previous working methods [11].

III. Modern technologies and their impact on IT project Management

Information technology industry is considered to be one of the fastest growing industries in many countries, while innovation and development of modern technologies have significant impact on improvement of business practices [12]. In regard to technology changes, IT project management is becoming more complex. Development of traditional technologies and tools, that have been commonly used in project management practice, led to the third generation of project management [13]. This generation is mostly influenced by changes in modern technologies that have emerged over the last few decades.

Some authors [9, 14] pointed out that a small percentage of IT project failures can be considered as a consequence of technical challenges. However, the same authors believe that a project will be unsuccessful if the used technology is obsolete or incompatible with the project, or if the technology is not appropriately used. Because of that, many organizations seek to gain competitive advantages and achieve better project results by investing in research of the modern technologies. According to [7, 15, 16] there is a range of new technologies that have influenced project management practice, and therefore IT project management itself. Those that are considered to be the most prominent are Cloud computing, Internet of Things and Artificial Intelligence.

A. Internet of Things

The Internet of Things (IoT) can be defined as a large-scale network that has been developed with the intention of connecting *Things* into one network [17]. From the aspect of IoT, *Things* can be defined as smart devices that can communicate between the IoT network and the real environment in which they are located [12]. IoT is an ever-growing infrastructure of internet-connected devices [7].

From the aspect of project management, IoT has an impact on various changes in project environment [13], such as: in power structures, in managers' abilities and skills, in standard procedures, etc. Given that the literature review revealed that success of a project depends on communication and information exchange within a project team [8], it is interesting to consider the possibility of IoT's impact on this issue. It can be concluded that IoT had an influence on project management performance improvement by enabling people to connect in groups with the help of smart devices that can serve as a mean of communication and receiving commands [7]. In addition, IoT provides intelligent management support based on analysis of large amounts of collected data [15]. More precisely, IoT provides access to a comprehensive set of information, based on which it can provide a real-time support and solutions in decision-making processes. From the same aspect, IoT enables collecting essential data from costumers and users, based on which companies can anticipate and plan better maintenance activities. This advantage is very significant from the aspect of IT projects. Beside above mentioned benefits of IoT usage in project management practice, there are other benefits that have been explored in numerous research studies [16, 17, 18].

One of the research studies in the IT industry [17] examined the impact of IoT in cases of software projects based on *agile* methodologies. This study indicates that IoT can serve as a support to various cases in which *agile* has no solutions or should be optimized, e.g. in case there is a need for productivity increase. According to this study, IoT has an impact on following IT project management parameters: team performance, team efficiency, team creativity, collaboration; and more optimized process of *agile* development. Improvements in *agile* methodologies can be achieved by simply incorporating smart devices into the entire process. This should be done in such a way that it increases the team's productivity by optimizing the usage of resources, to increase the communication between team members, and finally, to increase creativity and improve the final product by carrying out some of the team members' work.

According to [19] it is very important to understand that the adoption of IoT technology within project management will not have any benefits unless potentials of the technologies are not fully utilized. In the same research, the full utilization of IoT potential is explained as the extent of IoT prevalence in an organization, as well as the extent to which employees in an organization accept and implement technologies on a daily basis.

B. Cloud computing

Cloud computing represents a new approach in the IT industry, as well as one of the most significant trends of this industry. According to Nacional Institute of Standards and Technology, cloud computing could be defined as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction" [20]. This definition emphasizes the most essential characteristics of cloud computing.

There are various of research studies from different fields of project management [21, 22, 23] that deal with the impact of implementing these technologies in project management practice. According to these research studies, cloud computing has been identified as an innovation that makes processes and functions more flexible and remotely accessible. Some of the basic advantages of cloud implementation are reflected in the ease of communication and collaboration between team members, but also in the ability of client involvement in management of projects.

Research studies in the IT field suggest that cloud-based project management can provide support for problematic situations in IT projects, especially in software projects. First of all, cloud computing provides support in case of a dislocated team, especially in agile methodologies. By using cloud computing, project managers can monitor all phases of the software development life cycle, but also the participation and contribution of each team member.

Another advantage relates to the usage of cloud computing to achieve better communication between clients and companies, as well as a greater transparency in all IT project phases. In that way, cloud allows costumers to easily monitor and change their requirements, but also enables project team real-time insights into the project requirements. Implementation of cloud computing can prevent problems with incomplete requirements and specifications, changing requirements and unclear project objectives. Benefits in terms of user requirements are considered to be the major ones, given that requirement problems are claimed to be a significant factor for IT project failure [24].

C. Artificial intelligence

Artificial intelligence (AI) can be defined as a process of "designing and building of intelligent agents that receive precepts from the environment and take actions that maximize its chance for successfully achieving its goals" [25]. From the aspect of project management, AI can be seen as an integrated system that can manage projects without the need for human inputs.

It is expected that project management will become greatly influenced by AI, which will be reflected in the way in which management tasks are performed, as well as in changes in project control and delivery [7]. According to [26] there are four forms of AI in project management:

1. *Integration and Automation*. It is believed that, in the future, AI might eliminate 80% of human work which will allow project managers to have more time for other complex tasks.
2. *Chatbot Assistant*. With the usage of this operation, it will be possible to perform routine tasks (such as organizing meeting, answering simple questions, etc) more efficiently. This will increase efficiency of the human-computer interaction.
3. *Machine learning-based project management*. In order to analyze a project, AI will have access to a large amount of data from previous projects and gain experience. Afterwards, dealing with the data from a new project, AI will be able to predict costs, probability of meeting deadlines, and even possible issues. In that way AI may provide assistance in decision making processes.
4. *Autonomous Project Management*. At this stage of development and implementation AI can analyze and manage a project based on information it gathers.

It is clear that, by using AI, both project manager and project team will be able to achieve much more with less effort and less time [7]. However, AI should only be seen as an assistant and a strategic advantage, not as a replacement for project managers.

IV. Impact on Education

There is a widespread view that professional competence derives from knowledge gathered through formal education and experience, and that attitudes, behaviors and skills are formed by applying the acquired knowledge [27]. Development of professional competence will be effective only if experience is supported by science.

It is considered that education for IT project management should be firmly focused on the timeless aspects of professional competence, among which is the aspect of innovation and new technologies. However, one of the key challenges in IT education is to enable faster adjustment to changes and development of IT technologies [28]. According to [29], once the IT project management curriculum is established, there should still be a possibility of changing it. It is pointed out that the curriculum should be changed in response to students' needs and expectations. Changes in curriculum should reflect results from new research studies and new best practices. New technologies should also be included in education practice. Considering above mentioned, additional research must be focused on examination of modern IT trends.

V. Conclusion

In last few decades, new technologies, such as Internet of Things, Cloud Computing and Artificial Intelligence have been developed and that led to the improvement and reorganization of IT project management. Both the changes that occur in the IT industry and the influence of new technology development on IT project management, are presented in this paper. The awareness of new technologies should be very important for organizations and project managers, as well as the ability to focus on strategies and plans that are used to implement those technologies. It is considered that the lack of knowledge in the field of information technologies, and especially modern technologies, has a great influence on the IT projects success. For this reason, education has to be focused on new trends in the IT industry and to enable faster adjustment to changes and development of IT technologies. Changes in education should arise as a result of changes in the IT field, enabling students to gain professional competence.

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Techniques and Technologies in the Educational System of the Republic of Serbia

M. Kovačević*, I. Tasić**, P. Dašić***, N. Tasić*
*Technical College of Applied Sciences in Zrenjanin, Zrenjanin, Republic of Serbia
**University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
***Technical Mechanical College, Trstenik, Republic of Serbia
miodrag.kovacevic@vts-zr.edu.rs

Abstract - Analyzing the set goals of teaching and learning in the subject of technology and technology in the education system of the Republic of Serbia, it is noted that students should develop technical, technological and digital literacy, to build a responsible attitude towards collection, work and production, living and working environment, use of technical, and technological resources, to gain a better insight into their own professional interests, explore the world of work, act responsibly, initially and responsibly. Qualifications represent a formal recognition of acquired competencies. An individual gets a certain qualification when one competent body determines that he has achieved appropriate learning outcomes within a certain level of practice and training, according to a given standard of qualification, which, as a rule, is confirmed by a public document issued (diploma or certificate). In addition to qualifications, it is also necessary to emphasize the importance of competencies, which are an integrated set of knowledge, skills, abilities and attitudes that enable qualified individuals to work effectively in accordance with qualification standards. Key competences for lifelong learning are the ability to use acquired knowledge, skills and attitudes necessary for personal, social and professional development and further learning. All competencies are embedded in the goals and standards at all levels of education as a new area relevant to the continuous acquisition of competencies, the conduct of private and social life, the profession and the way in real problems and challenging situations. Learning outcomes provide clear statements about what an individual is expected to know, understand, and is capable of showing or doing at the appropriate time, or after the completion of the learning process. Enabling the verification of the level of development of competences, achievement of knowledge, skills, attitudes and abilities necessary in every well-organized education system. The standard of qualification is a document established in accordance with the relevant laws of the legal system of the Republic of Serbia, which contains a description of the objectives and the learning outcomes, as well as the qualification data on the basis of which the level is determined, its classification and evaluation. Enabling the verification of the level of development of competences, achievement of knowledge, skills, attitudes and abilities necessary in every well-organized education system. The standard of qualification is a document established in accordance with the relevant laws of the legal system of the Republic of Serbia, which contains a description of the objectives and the learning outcomes, as well as the qualification data on the basis of which the level is determined, its classification and evaluation. Enabling the verification of the level of development of competences, achievement of knowledge, skills, attitudes and abilities necessary in every well-organized education system. The standard of qualification is a document established in accordance with the relevant laws of the legal system of the Republic of Serbia, which contains a description of the objectives and the learning outcomes, as well as the qualification data on the basis of which the level is determined, its classification and evaluation.

I. INTRODUCTION

The National Education Council of the Republic of Serbia adopted at the meeting held on 9 May 2017. The programs for the four subjects of the second cycle of primary education, the fifth class - Informatics and Computing, physical and health education, engineering and technology and music culture. The National Education Council of the Republic of Serbia expressed its position on the programs of other cases at the next session held on May 23, 2017. Members of the National Education Council had objections regarding programs for the second cycle of basic education and education. Most of them bothered what the curriculum was doing only for the fifth grade, and it is not known how the program will be for the sixth, seventh and eighth grades at the moment of adopting the curriculum solution for the seventh grade. The curriculum for the fifth grade was developed by the Institute for the Advancement of Education at the initiative of the Ministry of Education, Science and Technological Development. Organized by the Ministry of Education, Science and Technological Development, the Institute for Quality Education and the Institute for the Advancement of Education, from 25 - 29 October 2017, at the Institute for Advancement of Education and the Institute for Quality education held a one-day training for 75 trainers who subsequently trained 2,600 teachers techniques and technologies to implement a new curriculum for 5th grade. The training included a four themes:

a) The curriculum of the subject technology and techniques;

b) The ratio of cross-curricular competencies and curriculum techniques and technologies;

c) Entrepreneurship as a cross-curricular competencies and

d) Project teaching.

The objectives of the training were:

a) familiarize participants with the training curriculum of the new object technology and techniques for the 5th grade of primary school;

b) introduction to curricular competencies with a focus on entrepreneurship and

c) use of project-based learning and relevant program content directed towards outcomes.

Such models of training and training continued during 2018 and 2019, when professors trained in techniques and technology for the realization of the object in the sixth or seventh grade. Implementation of object technology and techniques in the eighth grade under the new program of teaching and learning will start from the school year 2020/2021 years.

II. INSTRUCTIONS THE METHODOLOGICAL IMPLEMENTATION PROGRAM TEACHING AND LEARNING

Teaching technology and techniques is intended mainly for the development of core technical competencies for his training for life and work in a world that is now technically and technologically rapidly changing. The most important task of this course is that the student developing awareness that the application of acquired knowledge and skills in a real environment we need continuous professional training and adopt the concept of lifelong learning as a necessary and that the development of entrepreneurship is one of the important preconditions for personal and professional development.

Program teaching and learning for the second cycle of basic education-oriented education is the achievement of outcomes. Outcomes are statements of what students know how to do based on the knowledge gained by learning object technology and techniques. A description of the integrated knowledge, skills, attitudes and values of students in five educational topics:

a) Living and working environment,

b) Traffic,

c) Technical and digital literacy;

d) Resources and production and

e) Constructors modeling.

III. PLANNING TEACHING AND LEARNING

Starting from the given outcomes and content of teacher-created its annual global work plan that would later develop their operational plans. Defined outcomes facilitate teacher further operationalization of concrete outcomes at the level of teaching units. When planning should bear in mind that the outcomes differ to some easier and faster can be achieved, but for most outcomes need more time and more different activities. Classes are not planned according to the structure of textbooks, students should investigate the textbook as a source of data and information in order to develop cross-curricular competencies. In addition to textbooks, as one of the sources of knowledge, the teacher is to enable students to use insight and experience and other sources of learning. Preparing for time implies defining target time concretization outcome than the target time, planning activities for students and teachers in relation to outcomes, way of verifying the achievement of outcomes and the choice of teaching strategies, methods and processes of teaching and learning (taking into account prior knowledge, experience students, which will enable students to master knowledge and skills provided defined outcomes). Visits to museums techniques, fairs and tours of manufacturing and technical facilities should be exercised whenever the conditions exist, to demonstrate the modern technical achievements, modern equipment, technological processes, work operations and the like. When this there are the right conditions, students should be provided with multimedia programs which is represented this theme. Teaching techniques and technology is theoretical and practical character, so classes should be implemented division of the Department to 2 (two) groups, with a maximum of 20 students, where there are justifiable reasons as well as technical and technological conditions for the implementation of the program objectives and the achievement of teaching. Program teaching and learning need to be entered on the connected classes 1 + 1 time (block teaching).

IV. ACHIEVING TEACHING AND LEARNING [4]

Students in each class comes with some limited knowledge in the field of engineering and technology, which have gained in previous grades or previous levels of education, as well as with certain life experiences in the use of different devices, technologies and equipment. Due to the volume of material that is tied to the achievement of teaching and learning in the second cycle of basic education in this paper will be presented only part of the teaching and learning in eighth grade.

A. Life and work environment

In the field of living and working environment of processed content is primarily related to electrical engineering, computer science and mechatronics. With the help of various media briefly shows the development of these branches of engineering as well as their interconnection. By way of example, students analyze the impact of the development of those areas in a modern way of life. He particularly points to contribute Serbian scientists in the development of Electrical Engineering and Telecommunications (Nikola Tesla and Pupin). The proper use of electrical appliances in the household represents the students as much as possible with practical examples using available teaching resources and multimedia, with special emphasis on energy saving and energy efficiency measures and health and safety at work and in everyday life. Students can explain the terms related to classes of energy efficiency of electrical devices on which students can make a comparison of electrical appliances according to the level of energy efficiency and data on the total annual consumption of electrical household appliances. Indicate the importance of the application of energy efficient devices in terms of ecology, economy and principles of the circular economy. In particular, it is necessary to analyze the possible dangers that can occur when using electrical appliances and possible consequences in case of non-compliance with instructions for their use. Indicate the procedures of operation in electric shock. For the selection of continuing education and future career is necessary to indicate to students the importance of interest in electrical engineering with examples from your living environment.

B. Traffic

View feature traditional means of transport should be rounded electronic subsystems, as well as the structures and functions of transport equipment electrically powered and hybrid vehicles. It is recommended that students independently, through the available sources of knowledge, explore the advantages and disadvantages of electric vehicles and hybrid vehicles and compare them with conventional vehicles. For this purpose it is possible to use different teaching methods (project method of teaching, a problem-solving, research, etc.). Through a multimedia show electrical and electronic system in transport equipment (passenger cars, mopeds). System elements (devices for the production and accumulation of electricity, starter, ignition unit labor mixtures, signaling devices, etc.) With a prior knowledge of the power machines (motors). Pay special attention to the purpose of the electronic device (electronic fuel injection, sensors for movement, cameras, vehicles without drivers, etc.). Look back and to the need for the correctness of these devices for safe participation in traffic. Transferring data remotely makes a special segment of traffic. It takes students closer telecommunication technology and point to the rapid development of telecommunications systems and their impact on everyday life. In this segment, process transfer of information through audiovisual means (radio and television), mobile phones, GPS systems, computer and wireless networks. If possible and depending on available equipment, in this work it is necessary to take advantage of available devices (mobile phones, tablets, computers, wireless networks and the like.) And practically realize mutual communication through them.

C. Technical and digital literacy

To introduce students to the basic symbols and designations used in electrical and electronic schemes and train them for their drawing. When implementing these activities use simple schemes. Demonstrate with software for simulation of circuits appropriate to the age and previous knowledge of students. Create an exercise in which students draw the electric scheme and use computer simulation to show its functioning. If the material and technical capabilities permit, students then assembled electric scheme on the desk and demonstrate their work. You can use the analog and digital components. It is necessary to devise exercises in which students will prepare and manage the electromechanical models using ICT and appropriate interface. The complexity of the model adapted to the conditions and equipment with which the school has. Combine knowledge and skills in programming that students have to clarifying the functions and operations of individual elements of the model. If students work with a variety of models to predict the weather for the presentation of specific solutions in the class. Briefly acquaint students with the possibilities of process control and things remotely using ICT (Internet of Things). Enable students to correctly read and interpret the characteristics of the components of ICT devices. Demonstrate their appearance and work in accordance with the conditions in the school. Develop activities in which students participate individually or in groups to explore the characteristics of such. computer components necessary for the implementation of specific request / transaction (playing certain games, working with specific software, etc.). Within this activity to predict the use of the Internet and the creation / design specifications of equipment by students respecting the fundamentals of business communication and e-correspondence. The recommended number of hours for the realization of this field is 18 classes.

D. Resources and production

At the beginning of the study in this area to acquaint students with the power system of our country. What makes a power system, what are the needs for electricity, and the potential for production at our disposal. Production, transformation and transmission of electricity to explain with the help of multimedia. Briefly explain the hydro, thermal and nuclear power plants, the importance of transforming electrical energy in substations and electricity transmission lines and low-voltage power grid, from producers to consumers. When it comes to power generation, the content given to renewable electricity. This primarily refers to: solar power, wind power plants, geothermal power, biomass power plants, mini hydroelectric power plants and the combustion of municipal waste. These facilities realized with the help of appropriate multimedia. With students analyze the importance and benefits of production and use of renewable energy sources in terms of environmental protection. Using samples of electrical installation material, as apparent teaching means, or drawing and multimedia, to explain the pupils properties and application materials (wires, insulators, installation tubes and boxes, lamp-holders and lamps, switches, sockets, plugs, breakers, an electric power meter, the switching a clock). With the help of appropriate schemes and patterns coupled circuits, explain to students, primary circuits household wiring (circuit sockets with earthing, single-pole lamps, serial and alternating switch). Explain to students simplified scheme and the main features of the three-phase electrical installations. In explaining the electrical scheme to use three-phase current shown on the basis of a small apartment. Introduction of electrical installation material, and supplies the most effective can be established using various constructions of the circuits. Based on the acquired theoretical knowledge of students, with the help of teachers, practically assembled circuitry household wiring (circuit lamps with single-pole, serial and alternating switch ...). Connecting elements of circuits performed with the aid of mounting pins on the test plates or soldering. If you choose to solder, students demonstrate proper and safe use of electric soldering irons. Make sure that the simulation of circuits operate only with voltages of up to 24 (V). Use practical work students for a demonstration of a universal measuring instrument (multimeter). In practical work the students should use a multimeter to measure electrical quantities. In this field of work can be done with pupils simulation of circuits with the help of free computer programs intended for that purpose. Acquaint students with electric machines of direct and alternating current, and the main types of parts. Introducing students to electrical appliances and devices in the household do with the help of multimedia, image, or model (cross-section of individual household appliances and devices). Explain the main parts, the operation and maintenance of the most widely used method of Electro (stove, oven, iron, heaters, water heater...), electromechanical (vacuum cleaner, blender, juicer, refrigerator, freezer, air conditioning...) And combined appliances and appliances (hair dryers, electrical, washing machine, dishwasher ...). This part of the Module can be used to create multimedia presentations, so that every student on the same show and presented by a single device in the household. Within electronics, through examples of practical application, to acquaint students with the fundamentals that underpin the work of digital technology. With a practical demonstration to acquaint students with the basic electronic components (resistors, capacitors, coils, diodes, transistors, integrated circuits, ...). At the end of the area to acquaint students with the possibility and the importance of recycling electronic components from the ecological and economic aspects. This area is implemented in close correlation with the syllabus of physics, particularly in terms of the Law of Electrical Engineering at which they are undertaken by various devices on electro-thermal, electro-mechanical effects of electricity. The recommended number of hours for the realization of this field is 20 classes.

E. Constructors modeling

This area is more complex because it vertically connecting facilities to the preceding grade and eighth grade. In this part of the program the students through practical work apply previously acquired knowledge and skills through modeling of electrical machines and devices. This is necessary because this knowledge and skills appear in the implementation part of the project. In this class should be rounded unit of renewable energy sources. Given that in previous classes discussed the mechanical and thermal energy converters in the eighth grade, the focus is on electricity. Models that use renewable energy sources pupils can be modeled in different ways.

For this purpose, it is sufficient to operate on a smaller plate using multimeters to measure changes depending on the lighting conditions. Within the project it is possible to create a model wind turbine. With interface students are met at the "black box". Practically show how the interface that would, at a later stage, they apply their knowledge to a project. Students should be familiar with the basic parts of interface: power supply, inputs and outputs. In the same way to meet the basic parts of a robot and put together a simple robot school. Since the program is modular leaves the possibility for students to express their personal affinities, abilities, interests in order to identify some of those opportunities: creating a model of electrical machinery and apparatus, automatic systems, robots, electronic assemblies and models that use renewables Energy. The contents should be realized through the students' projects from the graphic presentation of ideas, planning, execution of the operations, marketing to assessment and evaluation. Continue with algorithmic approach in structural modeling approach especially in the development of technical creativity - from idea to realization. It is necessary for students to use data from different sources, independently find information on the conditions, needs and way of realization of products / models using ICT manufactured the product / model, while respecting the principles of cost-efficiency material and rational selection of tools and machines applying the procedure in accordance with the principles of safety at work. The project may involve more students (team work) if the work is complex, or if students are to decide this kind of cooperation.

When the project is completed, the students present the results they have obtained. It should allow self-assessment of their own work and the work of others on the basis of set criteria to develop the exchange of views and opinions. In order to improve the process of working on a project, it should encourage the use of electronic correspondence. It should implement activities related to the determination of the indicative price and the cost value model made during the presentation of the product / model. The recommended number of hours for the realization of this field is 18 classes.

V. MONITORING AND EVALUATION OF TEACHING AND LEARNING

Teaching oriented on achieving outcomes evaluated the process and products of learning. The evaluation process should take into account all the activities of students (neatness, systematic, commitment, initiative, creativity, etc.). Evaluation activities, especially if teamwork is concerned, it is necessary to perform with the group so that each member is seeking the opinion of his own work and the work of each member individually (peer evaluation). When evaluating the achievements of each is necessary to the teacher with the students agreed indicators on which everyone can monitor progress in learning. In this way, students will be encouraged to reflect on the quality of their work and ways to improve it. Rating becomes an instrument for the advancement of learning. Based on the results of monitoring and evaluation, together with students should plan the learning process and choose appropriate learning strategies.

VI. VOCATIONAL EDUCATION [3]

Secondary vocational education in the Republic of Serbia takes three or four years and prepares students for inclusion in the world of work. Law on Primary Education stipulates that all students who have completed secondary education have access to higher education, but usually this is true only for students who have completed four-year high school programs, while those whose education lasted three years with the possibility of special rates for access to higher education. Higher education institutions autonomously decide on the conditions of entry, because some institutions choose to enroll in a three-year high school students without additional qualifications. Some of the schools also provide a one or two-year specialization, apprenticeships and other forms of training (for example, adult training). All four high school students can continue to higher education if they so choose. Schools are mostly free public schools, but there are also private and foreign schools in the education system in the Republic of Serbia.

The subject technology and techniques before enrolling in vocational education that includes schools that offer education and specialization in the following areas, providing basic knowledge of the following areas:

a) agriculture, food production and processing,
b) geodesy and construction,
c) electrical engineering,
d) textile and leather industry,
e) traffic,
f) mechanical and metal processing,
g) geology, mining and metallurgy and
h) forestry and wood processing,

VII. HIGHER EDUCATION IN THE FIELD TECHNIQUES AND TECHNOLOGY

According to the type, qualifications in the National Qualifications Framework of the Republic of Serbia classified into:

general - primary education and upper secondary school education that encompasses all types and directions of high school and specialized high schools, in accordance with the laws governing the basics of education, primary and secondary education;

a) technical - vocational education, secondary arts education and training, in accordance with the law governing the basics of education, vocational training, dual training and adult education;

b) academic - higher education acquired by completing basic academic, academic master, specialist academic and PhD studies, in accordance with the law governing higher education and

c) vocational - higher education gained in basic vocational, vocational specialist and master vocational studies, in accordance with the law governing higher education.

VIII. CONCLUSION

Problems related to the implementation of teaching technique and technology in primary school is inevitably reflected in the following levels of education (secondary vocational education and higher education). Obsolete methodology, lack of trained teachers, outdated educational technology are just some of the major obstacles of realization of the program in the teaching and learning of the subject technology and techniques. It is necessary to significantly innovate curricula of study programs in higher education that educate staff to work in primary and secondary vocational schools, and teachers who are employed without prior mastery of pedagogical and psychological subjects is necessary to provide additional support to employment in secondary vocational schools. In May 2019, finally after nearly 40 years changed Rate of school space, teaching equipment and computer equipment that are envisaged for the realization of the Teaching and Learning Program of the subject technology and techniques.

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A/D and D/A Converters

N. Tasić, D. Lacmanović, M. Pardanjac, D. Milanov
University of Novi Sad, Technical faculty Mihajlo Pupin, Zrenjanin, Republic of Serbia
dusanka.milanov@tfzr.rs

Abstract - A / D and D / A conversion processes represent the fundamental part of an electronic device. Without the signal conversion process, the hardware would not exist, neither would the technology which makes our daily lives easier.

I. INTRODUCTION

A/D signal conversion is a process which converts an analog signal such as the sound picked up by a microphone or the light which enters a camera into a digital signal. A/D conversion can be used for measuring isolated values, for example, multimetres which convert the input voltage value into a digital number which presents the size of the voltage or current. Usually, a digital output consists of two complementary binary numbers which are proportional to the input, but there are also other variants. [1]

There are a few A/D converter architectures. Because of the complexity and the need for the precision of the sorted components, all except from special A/D converters are implemented as an integrated circuit.

A/D converter converts the analog signal which is a signal of continuous time and amplitude into a digital signal which is discrete, discrete time and amplitude. The conversion includes the quantization of the input signal so that there is a small amount of noise, i.e. a mistake during conversion. Therefore, instead of continuous conversion, the A/D converter is converting periodically, sampling the input signal, limiting the width of the input signal.

The performances of the A/D converter are primarily defined by bandwidth and signal-to-noise ratio. The bandwidth is defined by the sampling rate. The signal-to-noise ratio is affected by many factors, including resolution, linearity, and precision, as well as interference. The A/D converter's signal-to-noise ratio is often summarized in the form of its effective number of bits – ENOB, the average number of bits which are restored during each measurement, without being a noise.

Ideally, the A/D converter has an effective number of bits which is equal to its own resolution. A / D converters are selected to match the bandwidth and the required signal-to-noise ratio which needs to be digitalized. If the converter operates at a selection rate greater than twice the bandwidth of the signal, then, according to the Nyquist–Shannon sampling theorem, perfect reconstruction is possible. The presence of a quantizer error limits the signal-to-noise ratio even of a perfect A/D converter. Otherwise, if the converter's signal-to-noise ratio exceeds the signal-to-noise ratio of the input signal, its effects can be cancelled resulting in a perfect digital representation of the input analog signal. [2].

II. A/D CONVERTER'S RESOLUTION

The resolution of the converter defines the number of discrete values which can be displayed on a set of analog values. Resolution defines the size of the quantizer error, thus defines the maximum average signal-to-noise ratio for an ideal A/D converter without using oversampling.

The values are usually preserved in an electronic, binary form. The number of available discrete values is assumed to be the base level 2.For example, an A/D converter with a resolution of 8 bits can encode the analog input signal at as many as 256 different levels (28 = 256). The values represent a range from 0 to 255 or from -128 to 127, depending on the needs.

Resolution can also be defined electronically and expressed in volts. The voltage change to transform the output level of the code is called the least significant bit voltage - VLSB. The A/D converter's resolution Q is equal to the least significant bit.

The A/D converter's voltage resolution is equal to the total range of the measured voltage, divided by the number of intervals:

$$Q = \frac{E_{FSR}}{2^M}$$

Where M is the A/D converter's resolution expressed in bits and EFSR is the full-scale voltage.

EFSR is obtained:

$$E_{FSR} = V_{RefHi} - V_{RefLow}$$

Where VRefHi and VRefLow are upper and lower voltage limits which will be coded.

Normally, the number of voltage intervals is given:

$$N = 2^M$$

Where M is A/D converter's resolution expressed in bits. Namely, one voltage interval is set between two adjacent code levels.

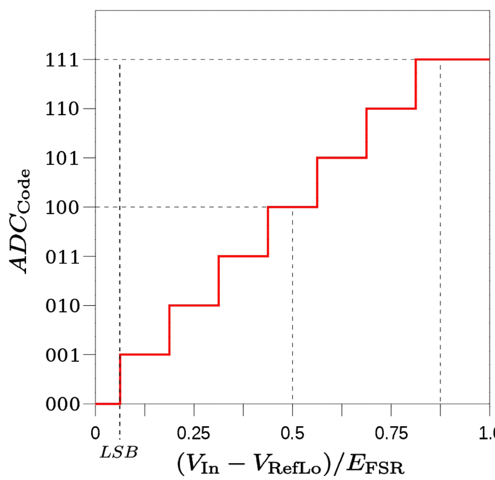

Figure 1. Encoding scheme

Example:

- Encoding scheme as in picture 1.
- Full scale range = 0 do 1 V
- A/D converter's resolution is 3 bits: 23 = 8 quantization levels
- A/D converter's voltage resolution Q = 1V / 8 = 0.125V

In many cases, the converter's useful resolution is limited by the signal-to-noise ratio and other errors in the entire system expressed as an effective number of bits (ENOB). [3]

A. Precision

The A/D converter has several sources of errors. Quantizer error and non-linearity (assumed that the converter is linear) are the integral parts of every analog-digital conversion. The errors are measured by the least significant bit (LSB).

B. Sampling rate

Analog signal is a continuous-time signal, therefore its conversion into a set of digital values is necessary. It is necessary to define the relation based on which the new digital values will be selected from the analog signal. The relations among new values is called the sampling rate or sampling frequency of the converter. A continuous changing signal can be selected (i.e. the value of the signal in the time interval T, sampling rate are measured and stored) and then, the original signal is reproduced by the values of the discrete-time interpolation formula. The precision of this formula is dictated by the combined effect of selection and quantization. Within the limits of the A/D convertor's high-resolution quantizer, the Nyquist–Shannon sampling theorem implies that the reproduction of the original signal is authentic only if the sampling rate is bigger than the double maximum frequency of the signal. For the final resolution of the quantizer, the sampling rate which is smaller than the double of the highest frequency usually leads to the optimal digital representation. Since the practical A/D converter cannot perform an instant conversion, it is necessary that the input value stays constant while the converter performs the conversion (conversion time). The input wheel called "sample and hold" performs this task – in most cases, by using a capacitor that stores the analog voltage from the input. Many A/D converters of integrated circuits include within themselves a "sample and hold" subsystem. [5]

C. Arduino ADC example

We will use Arduino for the detection of the analog voltage. Voltage can be produced by using a potentiometer or light sensor or a simple voltage divider.

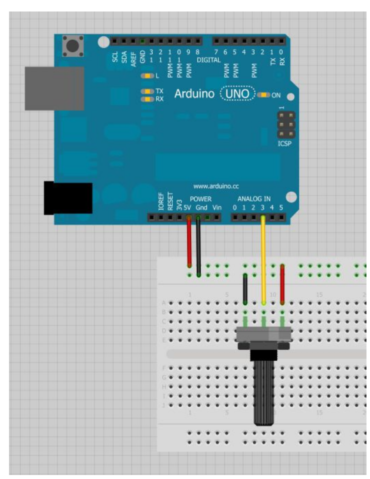

Figure 2 - Arduino

At first, we will define the pin as the input. In order to follow the scheme of the circuit, we will use A3:

```
pinMode(A3, INPUT);
```

and then we will do an analog into digital conversion by using analogRead() command:

int x = analogRead(A3); //the reading of the analog value on the pin A3 into x variable

The value which is returned and written down as x will have a value between 0 and 1023. Arduino has a 10-bit ADC (210 = 1024). The value is stored in int (integer) because x is bigger (10bits) than a byte (8bytes).

Displaying this value, the changes will be visible:

Serial.print("Analog value: ");

Serial.println(x);

As we change the analog value, x will also change. [1].

III. Digital into Analog Conversion

In electronics, D/A converter is a system which converts a digital signal into an analog one. There are many D/A converter architectures. The suitability of the D/A converter for the specific application is defined by these performances: resolution, the maximum frequency of selection and others. Digital-analog conversion can degrade the signal so that D/A converter should be specified with negligible errors in terms of its use.

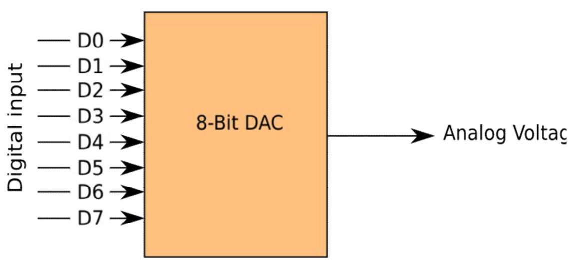

Figure 3. D/A converter

D/A converters are used within music players for converting a digital set of data into an analog audio signal. Also, they are used in the television and mobile phone industries for converting a digital video data into an analog video signal which is connected to screen drivers to display monochrome or color images.

These two uses utilize D/A converters at the opposite ends of the frequency/ resolution. Audio D/A converter has low frequency, high resolution while video D/A converter has high frequency, low to middle resolution.

Because of their complexity and the need for precisely paired components, all except special D/A converters are implemented as integrated circuits. Discrete D/A converters have typically extremely high-speed and low-resolution and they are hungry for power supply as they are used in military radar systems. Some oscilloscopes also use discrete D/A converters.

D/A converter transforms an abstract final number (usually a binary number) into a physical size (voltage or pressure). Specifically, D/A converters are usually used for converting finite – precise data in time into a continuously variable physical signal.

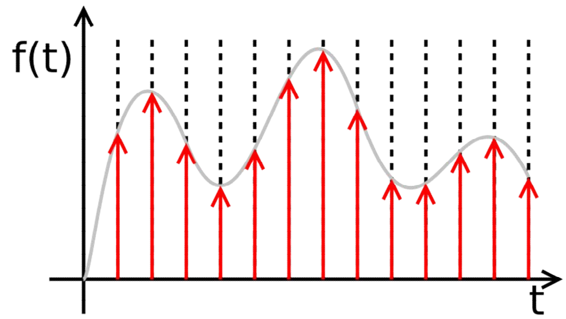

Figure 5. Conversion (finite– precise data in time into a continuously variable physical signal)

An ideal D/A converter transforms an abstract number into a conceptual sequence of impulses which are then processed by a reconstruction filter using some kind of interpolation to fill in the data between the impulses. A conventional practical D/A converter transforms numbers into pieces of constant functions made of sequences of rectangular functions.

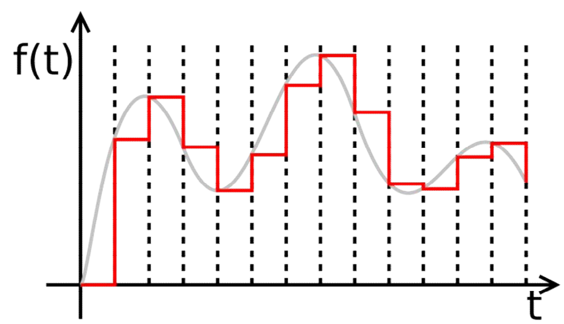

Figure 6. Conversion - numbers into pieces of constant functions made of sequences of rectangular functions

According to the Nyquist–Shannon sampling theorem, D/A converter can reconstruct the original signal from selected data under the condition that its bandwidth meets certain requirements. Digital selection introduces the quantizer's mistake which manifests as a low-level noise in the reconstructed signal.

IV. Conclusion

D/A and A/D converters are part of the technology which contributed to the digital revolution. To illustrate, imagine a typical remote phone call. The voice of the user on one end is converted into an analog electric signal with the help of the microphone, then, the analog signal is converted into a digital set with the A/D converter. The digital set is divided into network packages where digital data is sent. Afterward, the packages arrive at the destination, but every package can travel on a different route and it even does not have to be delivered in the same order as it was sent. The digital voice data is extracted from the package and compiled into a digital set of data. D/A converter transforms that set back into an analog electric signal which empowers the audio amplifier, which is further triggered by a speaker that ultimately produces a sound.

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Developing New Approach to Reduce Risk in the Process of Adoption Decision

K. Petrović*, N. Ilić*, V. Nikoić*,**, B. Markoski***, N. Jancev****
*The University of Criminalistic and Police Studies, Belgrade, Republic of Serbia
**MoI RS, Ministry of Interior Republic of Serbia, Beograd, Republic of Serbia
***University of Novi Sad, Technical Faculty Mihajlo Pupin, Zrenjanin, Republic of Serbia,
****Higher Medical and Business Technological School of Applied Studies, Šabac, Republic of Serbia

Abstract - This paper deals with methods of decision making in conditions of uncertainty and risk. Methods under conditions of uncertainty are: the optimistic (maxandmax) method, the pessimistic (maxandmin) method, the optimism-pessimism method (Hurwitz), the maxandmax reward method (Sevidge), the principle of insufficient cause (Laplas). Methods in the conditions of risk are: the maximum expected value method (MOV), the method of expected repulsion (OK), the maximum expected utility method (IOC). And each of them will be explained in this paper.

I. INTRODUCTION

In practice, the most common situations are situations in which the outcome of each particular action is influenced by numerous uncontrolled factors, or the circumstances in which it is carried out.

So far it has been assumed that a set of possible events is complete and that events are so defined that they are excluded from each other. The likelihood of their individual reporting is ignored. According to this criterion, three types of conditions are distinguished in which decisions are made, which are:

- conditions (complete) uncertainty;
- risk conditions (measurable uncertainties);
- conditions of certainty.

II. SELECTION METHODS IN CASE OF UNCERTAINTY

- Optimistic (Maxandmax) method;
- Pessimistic (Wald or Maxandmin) method;
- Method of Otimism-Pessimism (Hurwitz);
- The method of minandmax remorse (Sevidov);
- The Principle of Insufficient Reason (Laplas).

The above methods are based on different logical bases, which makes their final choices different from each other.

A. *Optimistic (maxandmax) method*

The decision maker who defines this method is optimistic about the possible results. He starts from the unrealistic assumption that an event that will enable him to achieve the best result possible by the chosen action will always be realized.

The process thus comes down to comparing only the best results of all actions and the best choice among them. Hence the name maxandmax method, which symbols are expressed as follows:

$$max_i \{max_j (u_{ij})\}, i = 1,2, \dots, n, j = 1,2, \dots, n$$

B. *A pessimistic (maxandmin) method*

The decision maker applying this method exposes to express pessimism regarding future results, because it expects the action to be implemented in the most unfavorable circumstances. In other words, whatever action we choose, we expect to achieve its worst result. For this reason we choose the action that guarantees the best among the worst outcomes, that is, the action that maximizes the minimum utility:

$$max_i \{min_j (u_{ij})\}, i = 1,2, \dots, m, j = 1,2, \dots, n$$

C. *The method of optimism-pessimism (Hurwitz)*

In rational decision-making, there is no room for ungrounded optimism or excessive pessimism. That is why Hurwitz proposed their modification in the so-called. the method of optimism-pessimism, by which actions are judged based on their extreme outcomes. In order to be correct in the evaluation, the extreme outcomes of all actions should be evaluated in the same way. Therefore, we evaluate each action on the basis of the weighted sum of its best and worst results, where the weights (weight coefficients) are the same for all actions. The best outcome is the so-called. The index of optimism, a (0 £ a £ 1), and the weakest outcome with his complement, 1- a. The Hurwitz method is:

$$max_i \{max_j (u_{ij}) \times \alpha + min_j (u_{ij}) \times (1-\alpha)\}, i = 1,2,\ldots,m, j = 1,2,\ldots,n$$

D. The method of minimization of repulsion (Sevidge)

The Sevidge method can not be applied to the original data shown in the pay tables, but it is necessary to form a new table. We call it tables (matrix) of losses and we carry it out from the original table in the following way: For each event Sj, j = 1,2, ... n, (in every column) we come across the best outcome (maxiuij = Uj, i = 1,2,.., m).

we assign this outcome to zero in the loss table, because in the case of the selection of the best-performing action there is no remorse. Poverty occurs if we have chosen one of the remaining actions; it is shown by the difference between the best outcome in the column Sj, Uj and the outcome achieved by the application of the given action, i.e. kij = Uj-uij.

E. Principle of insufficient reason (Laplas)

So far, the above methods ignore the probability of reporting certain circumstances.

Their authors explained this in the fact that under conditions of complete uncertainty it is meaningless to talk about the probabilities of reporting certain events. Nevertheless, despite the maximum uncertainty, the decision-making table contains all the events that can be reported.

By the act of inclusion of individual events into the model, we already assign probabilities different from zero and we are sure that one of them will appear. If our probability is unknown, we can, for example, assume their equality.

Laplace's postulate: If I do not know anything about future events, then I can think they are equally probable "is also called the principle of insufficient reason. When we associate equal probabilities in the decision table with individual events, the task is reduced to calculating the expected utility of the shares. The expected utility of the action is calculated as the weighted sum of the usefulness of its possible outcomes.

III. Decision in risk conditions

Under conditions of uncertainty, decisions are made only on the basis of possible outcome actions in different circumstances. As is known, in the conditions of risk, the probabilities of reporting certain events, which are included in the analysis, are also an important determinant of the final selection.

A. Decision-making phases in risk conditions

A priori analysis

At this stage, the problem is shown by the decision table and based on the initially determined (a priori) probability of the event, the expected values of the shares are calculated, as well as the expected value of the complete information (OVPI). Based on it, a decision is made whether the final choice will be made immediately or the adjournment of the decision will be postponed and collected additional information. If the OVPI value is small, then the supplementary information is not supplied, but the decision is immediately passed, i.e. an option with the maximum expected monetary value is selected. Otherwise, if the OVPI is large, it is accessed at the next stage.

Preaposteriori analysis

At this stage, reliable sources of information are defined, whose engagement is economically justified. The price of the information should be low compared to the OVPI, and the previous experience with the selected source of information should be positive, in the sense that the previous forecasts were reliable.

A posteriori analysis

If the purchase of supplementary information is justified, then it is procured and changes the initial probability of the event. Then, using corrected, and posteriori, probabilities calculate the expected values of the observed shares and make the selection based on the results obtained.

Future analysis

It is possible that the results obtained raise new questions and point to the need for new information. Then the entire procedure is repeated. With each subsequent inclusion of supplementary information, previously calculated and posteriori probabilities are treated as initial a priori probability, then their correction is made to new and posterior probabilities, until they finally give up on the collection of new information and approach the selection of the action.

B. Methods of selection under risk conditions

- Maximum Expected Value Method (MOV);
- The expected remission method (OK);
- Maximum expected utility (IOC) method.

Maximum Expected Value Method (MOV)

The maximum expected value method leads to the ranking of the alternative based on the expected value which represents the sum of the outcome of the alternatives weighted by the probabilities of their formation.

PRODUCT	DEMAND LEVEL		
	LOW	AVERAGE	HIGH
P1	-10	160	260
P2	-20	130	300
P3	-40	180	280
PROBABILITY	0,30	0,60	0,10

Table 1: Example of the expected value method (MOV)

PRODUCT	RENDERING THE OUTCOME OF THEIR VERSION OF THEIR EVENT	EXPECTED VALUE
P1	0,30×(-10) + 0,60×160 + 0,10×260	119
P2	0,30×(-20) + 0,60×130 + 0,10×300	102
P3	0,30×(-40) + 0,60×180 + 0,10×280	124

Table 2: Example evolution of the expected value method (MOV)

The expected remission method

- It is based on the principle that it is necessary to minimize possible damage, which may arise if it turns out that the decisions made are wrong.
- First of all, from the standard matrix, the so-called. "Regression matrix" (regret) that shows "missed winnings", and then apply this minmax criterion to this matrix.
- The remission matrix is formed on the basis of the difference in the results that would have been obtained in order to know in advance what will be the state of the future (max. Ai) and the results obtained by the decision (s).
- Reduction (or loss of opportunity) of the Ai action, i.e. OK (Ai) can define as: $OK(A_i) = p_j \times k_{ij}, i = 1,2, \ldots, m$
- where expectations are expected to be remedied if the decision maker chooses action Ai, and the state of Sj is realized.
- Application procedure
- First of all, from the original matrix, the maximum results given by individual states of the future are set, and the results of these results are set to zero
- The other values in the matrix of regret are obtained by subtracting the residual values of the results by columns from the selected maximum results
- Minmax criterion is applied.

Maximum expected utility method (IOC)

In order to apply the maximum expected utility method, it is necessary to express all the outcomes in the decision table with their cardinal benefits. The expected utility of the action is equal to the sum of the products of its outcomes (expressed in units of cardinal utility) and the probability of their occurrence (probability of the event):

$$u(A_i) = OK(A_i) = \sum_{j=1}^{n} p_j\, u(V_{ij}) = \sum_{j=1}^{n} p_j\, u_j, i = 1,2, \ldots, m$$

ACTION	EVENT		EXPECTED USE OK(A_i)	MOK
	S1	S2		
A1	0	1	0,5*0+0,5*1=0,5	
A1	0,65	0,95	0,5*0,65+0,5*0,95=0,8	0,8(A2)
PROBABILITY	0,5	0,5		

Table 3.: Example of the maximum expected utility method (MOK)

IV. Decision tree

The tree is constructed from left to right and consists of two types of knots and branches that grow from them. The tree starts with the so-called. the decision node (represented by a square), whose branches represent possible actions, Ai, i = 1,2, ..., m. At the ends of these branches there are nodes of events (represented by circles) that bend to the branches of possible events, S ,. j = 1.2 ..., n. At the ends of these branches there are exits, Vij (or), i = 1,2, …,m, j = 1,2, .. n, which are products of consciously chosen realization of the corresponding event Sj.

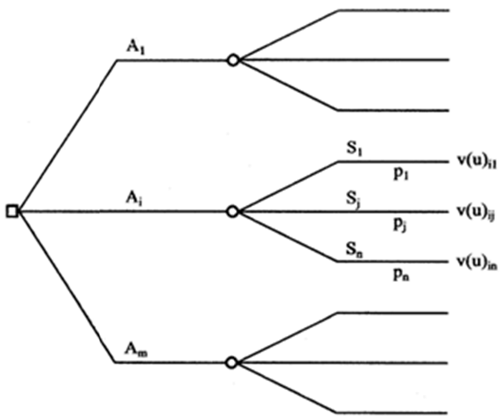

Figure 1: Decision tree

V. CONCLUSION

Expanding knowledge in mathematical methods in decision making under conditions of uncertainty and risk. Investigating the decision-making process for risk uncertainty. Developing new approaches and combining existing methods for modeling and solving specific business decision-making issues provides an effective management and decision-making tool and can be a factor in addressing the problem of inefficiency, which is also being met by our current economy. Choosing appropriate methods to reduce risk in the process of adoption decision, affects the positive effects of decisions made on the basis of such information support provided in relation to other conventional methods. The application of various methods for risk assessment is the basis for a better result.

Acknowledgements

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Deep Learning Voice Conversion Approaches

S. Arsovski, A. D. Cheok, S. Nurannisa Binti Abu Hamid
Imagineering Institute, Malaysia

Abstract - In this paper we will present Deep Learning Voice conversion (VC) approach. In order to modify source speaker voice signal (voice style transfer), we will use pre-trained Convolution Neural Network (CNN) for feature extraction. Two key research contributions will be presented in this paper; First, we will analyse different CNN architectures for image style conversion applied to the voice conversion and present novel data approach to voice conversion. Second, we will present novel data preparation audio signal transformation process. In the experiment that will be presented in this paper we will use pre-trained CNN model and random weight CNN model to process audio signals which have same content of speech with different speech style and, audio signals which have different content of speech and different speech style. Experimental results will be compared, and future work directions will be given.

I. INTRODUCTION

Voice conversion (VC) is a method aimed to modify source speaker voice to be perceived as if the target speaker had uttered it. The purpose of voice conversion is to conduct the transformation that makes the voice of the source speaker sound as spoken by the target speaker. The audio signal of speech carries different types of information such as non/paralinguistic content, speaker identity, and environmental noise. Voice conversion focuses on speaker identity information which contains the feature of target speaker. Application of voice conversion can be found in various field such as education, medicine, and entertainment. In education field, especially in learning foreign languages, intonations and pronunciation of non-existing phonemes in the native language would be most difficult tasks for students. Voice conversion could help students to learn foreign languages particularly on the pronunciation exercises where voice students would listen to their own voice pronouncing foreign sounds correctly Felps, Bortfeld, and Gutierrez-Osuna (2009). Transformation of voice can assist people with speech impairments to improve the precision of abnormal speech uttered by a speaker who has a speech organs problem Aihara, Nakashika, Takiguchi, and Ariki (2014). In the entertainment field, voice conversion is used in dubbing in movies and animation Turk and Arslan (2002). Dubbing can regenerate voices of an actor or actress who may lost their voice characteristic due to aging J.-Y. Lee, Bae, and Bae (2017). Voice conversion can be implemented to create a virtual character with desired speaker identity for various application such as video games and animation Cabral, Cowan, Zibrek, and McDonnell (2017). The key research contribution presented in this paper is the experimental analysis of the different CNN architectures for image style conversion applied to the voice conversion. We will analyses two CNN architecture, using a novel approach in the data preparation phase. The basic idea in our approach is to use the image style transformation Convolutional Neural Network (CNN) model described in L. A. Gatys, Ecker, and Bethge (2016) that use pre-trained CNN for object recognition, to modify the source speaker voice signal using the style features extracted from the target speaker voice signal. Authors in Ulyanov and Lebedev (2016), transform input audio signals into image (audio spectrogram). We have adopted a different approach, and directly transform input audio signals from one-dimension matrix that represent audio to three-dimension matrix that represent picture.

In this paper we will present experiments with a pre-trained CNN model and random weight CNN model, compare the results propose future work in the voice conversion approaches. The remainder of this paper is organized as follows: Section 2 describe related work. In section 3 presents, we review the CNN model architecture and explained our proposed method. Section 4 discusses the questions and implications. Finally, the research conclusion is provided by highlighting the main research contribution in section 5.

II. RELATED WORK

In recent years, several approaches for voice conversion have been proposed. Authors in Zhang, Tao, Tian, and Wang (2008) proposed a text-independent voice conversion method which uses a non-parallel audio dataset for target speech and source speech utterances. Authors Zhang et al. (2008), represent the phonetic structure of pre-trained speech dataset and generate training pairs of source and target speakers using the Hidden Markov Model (HMM). Hidden Markov Model are a ubiquitous tool for modelling time series data that applied in speech recognition systems which has capability to characterize spectral parameter sequence and model phonetic structure Ghahramani (2001). In the model from Zhang et al. (2008), a pre-trained speech dataset is used together with HMM. The role of the HMM is to map source speaker audio signal with target speaker audio signal in order to generate training pairs. The weakness of the model Zhang et al. (2008) is that it required large dataset of audio recordings to achieve good result. In our research, we utilize deep features provided by CNN model as presented in L. Gatys, Ecker, and Bethge (2015). We perform feature extraction and style transfer by optimization of the style texture of various scales from the source speaker voice signal.

Authors in C.-H. Lee and Wu (2006) presents a Gaussian Mixture Model (GMM) approach to achieve higher accuracy of speech conversion. Gaussian Mixture model teach developers (2007-2017), is defined as a probabilistic model that assumes all the data points are generated from a mixture of a finite number of Gaussian distributions with unknown parameters. Based on the author in C.-H. Lee and Wu (2006), GMM acts as a conversion function for each adaptation sentence pair that generated from Maximum A Posteriori Probability (MAP). Maximum A Posteriori Probability algorithm perform an estimation of the maximum likelihood of unknown quantity that equals the mode of posterior distribution. GMM implemented MAP adaptation to get the maximum probability of conversion. In our research, we are focused on transferring style speaker on parallel and non-parallel audio signal using a CNN model. Pooling layer is used to determine maximum pooling of speakers that have the same function as MAP adaptation in author in C.-H. Lee and Wu (2006) project.

Based on the author in Wyse (2017), neural style transfer model approach is used to perform audio style transfer based on successful of neural style transfer for image transferring distinct artistic styles in L. A. Gatys, Ecker, and Bethge (2015). Author in Wyse (2017) used conversion of audio signal to image representation in form of spectrogram image approached using phase reconstruction technique from Griffin-Lim algorithm. Spectrogram image is a 2D image that represent a sequence of spectra with time along the axis and the brightness or colour representing the strength of a frequency component in each time frame. VGG-19, a pre-trained neural network model is used to extract textual features from the audio spectrogram.

The approach presented in Ye and Young (2004) uses speech recognition technology to generate a mapping between the source spectral features and target spectral features extracted from the database. Speaker identity is represented by a 15-dimensional vector of Line Spectral Frequencies (LSF) that used to encode audio signal, and MAP technique is used to determine the audio signal transformation with the help of GMM trained on the source data. The conversion and transformation of source data undergoes refinement phase in order to reduce distortion and unwanted artefacts. Presented model use unit selection technique to capture vocal tract structure and as refinement phase depends only on target training data. By using HMM-based speaker independent speech recognizer force to align the target data and each target speech frame is labelled with state id and using the state id sequence of unknown speakers corresponding target is selected from target database with the maximum matching state sequences. Same approach is used for multiple transformations, and target data served as reference rather than source data. Based on the result in Ye and Young (2004), single audio data is sufficient to hide the identity of the source speaker and provide a voice which sounds like target speaker, but it is not suitable for multiple transformations. The goal of authors from Chorowski, Weiss, Saurous, and Bengio (2017) is to present a proof-of-concept system for speech texture synthesis and voice conversion. The author in Chorowski et al. (2017) used Connectionist Temporal Classification (CTC) network model to predict character sequence of the source and style speaker. CTC model consists a fully connected layer for filtering, and pooling window size based on time and frequency of speakers Chorowski et al. (2017). According authors in Chorowski et al. (2017) , presented approach has ability to utilize limited amounts of data from target speakers. Proposed approach is quite slow and require a high number of training step.

Focus in research presented in Perez, Proctor, and Jain (2017) is a voice style transfer for prosodic speech. Prosodic speech is an aspect of speech that deal with the auditory qualities of sound Selwyn-Jones (n.d.). Authors in Perez et al. (2017) uses a pre-trained CNN model as an auto-encoder to extract the feature from the audio signal. In the project, Voice Cloning Toolkit (VCTK) author uses 109 English speakers to create audio clips dataset. Each of the speaker's read 400 sentences from newspaper articles. Each audio clip undergoes conversion to spectrogram image using a Short-time Fourier Transform (STFT) with windows size of 2048. After the data preparation stage, the converted spectrogram image is trained using convolution auto encoder. The model in

Perez et al. (2017) consists of 4-layer CNN as the encoder and decoder, each layer consists of ReLU nonlinearity and Batch Normalization layer. In style transfer stage, the aim is to optimize more compact representation at each layer of CNN. Therefore, in the early layer of CNN encoded fine-grained and widely-distributed features and filters in deeper layers encode abstract, context-sensitive, structural features. The style loss is measured from Gram matrix of filter values which allow various representation of content at deeper layers. Furthermore, ADAM optimizer, Adaptive Moments Estimation algorithm for first-order gradient-based optimization of stochastic objective function Kingma and Ba (2014) is used to minimize a weighted sum of the content and style losses.

III. MODEL AND EXPERIMENT

A. Model

Goal of research presented in this paper is to modify source speaker voice signal using the style features extracted from the target speaker voice signal. Hence, our result will be new audio signal with a content of the source speaker audio signal and style of the target speaker audio signal.

B. Approach

In our experiments we will use CNN architecture (Figure 1.) for image style transfer presented in L. A. Gatys et al. (2016). CNN architecture has three major groups of layers: input layer, feature-extraction (convolutional) layers, and classification layers. Since, our goal is to transform style of audio signal, we transform audio signal from one-dimension matrix representation to the three-dimension matrix representation to get image representation of the audio signal.

C. Content extraction

In the CNN architecture, the feature maps in the convolution layers give to us representation of the image content, in our case give to us representation of the audio file content. Going deeper through network convolutional layers are able to represent larger features.

D. Style extraction

Authors in Ye and Young (2004) presents that it is possible extract the style of the image by analysing the spatial correlation of the values in extracted feature map. Mathematically we will calculate Gram matrix of a feature map. If the feature map is a matrix F, then each entry in the Gram Matrix G can be given by:

$$G_{i,k}^{l} = \sum_{k} F_{i,k}^{l} F_{j,k}^{l} \tag{1}$$

Proposed CNN network can transform input data from the input layer through all connected layers into a set of class scores given by the output layer.

The input layer is defined as a layer where the input data is loaded and stored before processed by the network Patterson and Gibson (2017). The input layer of the CNN model accepts three-dimensional input, width, the height of an image and depth that represents RGB color channels. Another layer of CNN architecture is convolutional layers and it is considered as the core building blocks of CNN architectures. Based on author Li and Karpathy (2015), convolution defined as a mathematical operation that bridge between the time domain and the frequency domain with the use of Fourier transforms that derived to merge two sets of information. The input of convolution can be a raw data or a feature map output from another convolution. The kernel is a set of weights in the convolutional layer. Kernel slides across the input data and multiple by the input data that creating a single entry in the output feature map.

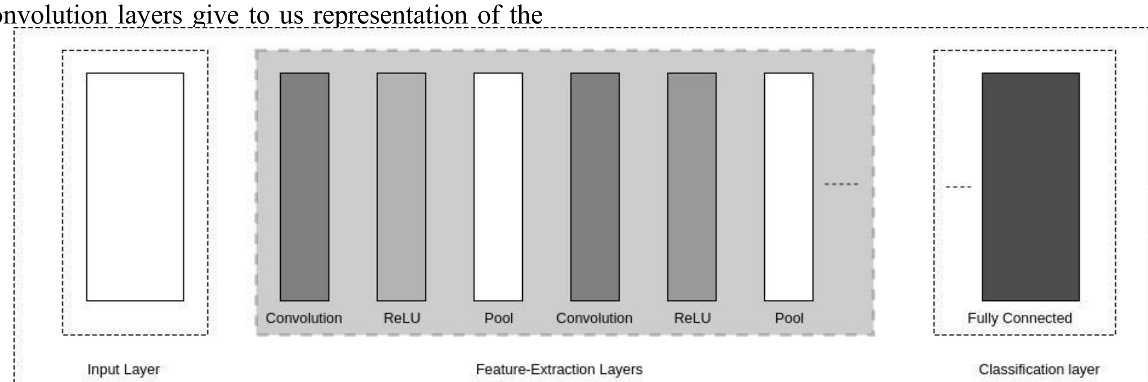

Figure 1. Architecture of CNN Model

Convolutional layers contain a parameter and additional hyperparameters. In this layer, the parameter is trained using gradient descent to produce the class scores that consistent with the labels in training set. A major component of convolutional layers is filters, activation maps, and parameter sharing and layer-specific hyperparameters. Filters have a width and height that smaller than the width and height of the input volume. Filters are applied for every depth, width, and height of the input volume. The output of the filter is computed by producing dot product of the filter and the input region. The architecture of CNN is set up in such way that the learned filters produce the strongest activation to spatially local input patterns. Filters are learned to activate on features only when the features occur in training data their respective field.

Another major component of the convolutional layer is activation maps which is the output of applying a filter to the input volume. Activation maps also defined by the author in Gil (2016) as a simple technique to get discriminative image region to identify the specific class in the image. In CNN model, ReLU layer is implemented to apply an element-wise activation function over the input data as is presented in Li and Karpathy (2015). Convolutional layer hyperparameter function dictates the spatial arrangement and size of the output volume that consists filter size, output depth, stride and zero padding. Furthermore, batch normalization is implemented to accelerate the training in CNN by normalizing the activations of the previous layer at each batch as presented in Gil (2016). Batch normalization also reduces the sensitivity of training towards weight initialization and acts as a regularizer.

Pooling layer is one of the layers in CNN model that inserted between successive convolutional layers that functions to reduce the data representation progressively over the network and help control overfitting. The pooling layer operates independently on every depth slice of the input. Based on the author in S.V.Avinash (2017), pooling layer used filters to perform down sampling process on the input volume. Depth slice is down sampled in the input volume by a factor of two on spatial dimensions. Pooling layer does not have a parameter because it computes a fixed function of the input volume. A fully connected layer is the last layer of CNN and function to compute class scores that use as the output of the network. Furthermore, the fully connected layers perform transformations on the input data volume that are a function of the activations in the input volume and parameters. This layer has a connection between all its neurons and every neuron in the previous layer.

IV. EXPERIMENT

The first task in the experiment was to prepare source speaker and target audio signal (content and style) to be processed by CNN for image style transfer. We use the one-dimensional array that represents audio signal and reshapes it to the three dimensional array using an algorithm in (2).Assume A is one-dimensional matrix that represent audio signal, product of multiplication of AT and B produce C that transpose to CT to be represent as image of audio.

$$\mathbf{A} = \begin{bmatrix} a & b & c \end{bmatrix},\ \mathbf{A}^{\mathbf{T}} = \begin{bmatrix} a \\ b \\ c \end{bmatrix},$$

$$\mathbf{B} = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix},\ \mathbf{B}\ \textit{which an identity matrix}$$

$$\mathbf{C} = \begin{bmatrix} a & 0 & 0 \\ b & 0 & 0 \\ c & 0 & 0 \end{bmatrix},\ \mathbf{C}^{\mathbf{T}} = \begin{bmatrix} a & b & c \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix},\ \mathbf{C}\ \textit{is a transpose to}\ \mathbf{C}^{\mathbf{T}} \qquad \mathbf{(2)}$$

Then we convert the three-dimensional array to the image using a PIL library for image processing. PIL which stand for Python Imaging Library that used to manipulate image Fredrik Lundh and contributors (1995-2011). The image representation of the source speaker audio signal is shown in Fig. 2.

We apply the same approach and transform style speaker audio signal which is shown in Fig. 3.

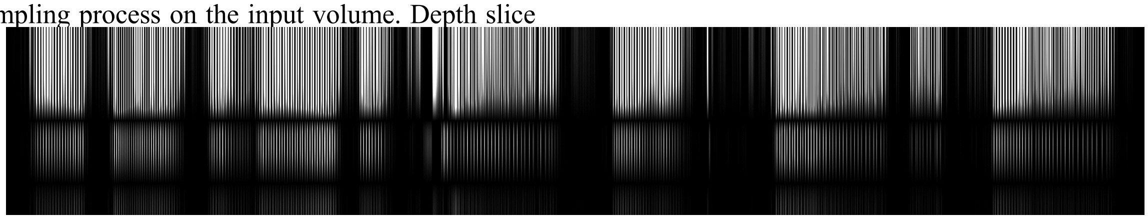

Figure 2. Image representation of the three-dimensional array of source speaker audio signal

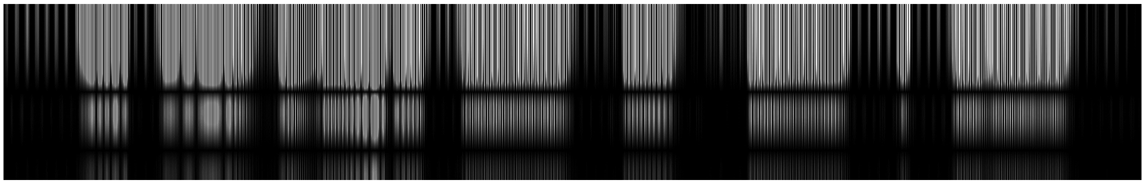

Figure 3. *Image representation of the three-dimensional array of the style audio signal*

In the next step of the experiment, we pass prepared images to the CNN model. Reconstruction of input image occurs in the convolutional layer that visualizes the information at different stages of CNN. For the style reconstruction, new feature space is built on top of filter responses in each layer to captures the style of the input image. Feature correlations of multiple layers produce a stationary, multi-scale representation of the input image on an increasing scale while discarding information of the global arrangement of the scene. Content reconstruction is performed using gradient descent from white noise image to find another image that matches the features responses of the original image.

Gradient descent is an optimization algorithm that used to find the values of parameters of a function that minimizes a cost function and best used when the parameters cannot be calculated analytically stated in Brownlee (2016). We minimize distances of white image noise from the content image and style image. In the first experiment, in order to get a result image, we use pre-trained VGG-19 CNN model for an object recognition from L. A. Gatys et al. (2016). The VGG-19 network model is trained in a subset of the ImageNet database which is built to understand image properties such width, height, and depth. Next step in the experiment was the conversion of the new image created by the CNN model to the audio signal. We use Griffin-Lim algorithm that is shown in (3).

$$x_{n+1} = istft(S.\ exp(I \cdot angle(stft(X^{n})))) \qquad (3)$$

Refer to (3) S represent three-dimensional audio array and istft is the inverse of short-time Fourier transformation.

Algorithm 1 Griffin-Lim Algorithm (GLA)

Require: Measurements $y(m,k) = |X_g\ (m,k)|^2$ and windows **g[n], k, n = 0, …, N – 1, m = 0, …, M-1** while halting criterion false **do**

$$\mathbf{l \leftarrow l + 1}$$

$$_g^l(m,k) = \sum_{n=0}^{N-1} X_{l-1}[n]\ g\ [mL - n]e^{-j2\pi kn/N}$$

Compute the STFT of X_{l-1} [n]

$$b\ (m,k) = \frac{x_g^l\ (m,k)}{x_g^l\ (m,k)}$$

Keep the and phase magnitude

Compute the inverse **DFT** $x_g^l\ (m,n)$ **of b** (m,k) **using**

$$\hat{x}_1[n] = \frac{\sum_m x_g^l(m,n)\ g\ [\overline{mL-n}]}{\sum_m |g[mL-n]|(m,k)|^{\ 2}}\ \{\text{update signal estimate}\}$$

end while

return $\hat{x}_1[n] \leftarrow \hat{x}_1[n]$

In the second experiment, we use different CNN architecture. For the style future extraction, we use Gram matrix CNN model with random weights and with the 4960 filters. Random weights networks are networks in which the weights that connect input-hidden layers are randomly selected and the weights hidden-output are obtained analytically Cao, Wang, Ming, and Gao (2018). Model result image is shown in Fig. 4.

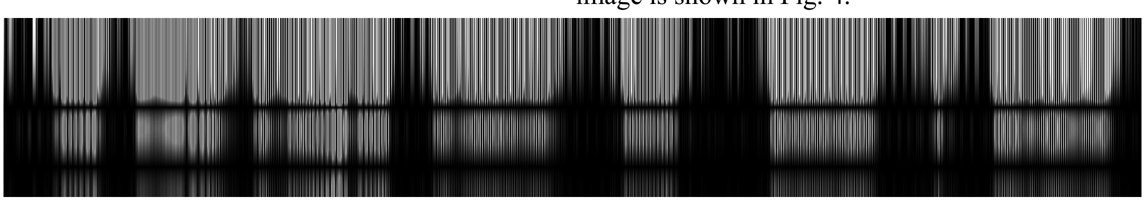

Figure 4. Result image of audio signal

We convert of the new created image to the audio signal using Griffin-Lim algorithm shown in (3). Pseudo code is given in algorithm 1.

V. DISCUSSION

In this research, we use pretrained CNN model for the image style transformation to process three-dimensional array that represents the audio signal. In the experiment, we also compare parallel and non-parallel approaches. A parallel approach is an approach where the both of signals have the same content of speech, but they are different in style. Nonparallel approach is defined as an approach where audio signals have different content of speech and different style.

To evaluate quality of the results we use Mean Opinion Score (MOS) method Recommendation (2006). MOS is the indicator of perceived media quality. According the International Telecommunication Union (ITU) MOS score is the "value on a predefined scale that a subject assign to his opinion of the performance of a system" Recommendation (2006).

We conduct experiment with the 10 listeners. In the quiet room we play converted voice signals obtained from pretrained CNN for image style and audio signals obtained from the Gram matrix CNN with random weights for both, parallel and nonparallel approach. Listeners was instructed to rate audio signal quality according scale presented on the Table 1.

Table I. MOS RATING SCALE

Rating	Label
5	Excellent
4	Good
3	Fair
2	Poor
1	Bad

The MOS is calculated as the arithmetic mean over single ratings performed by human subjects for a given stimulus.

$$MOS = \frac{\sum_{n=1}^{N} R_n}{N} \quad (4)$$

Where R are the individual ratings for a given stimulus and N is the number of subjects. In the preparation phase of the experiment listener where introduced with a reference audio signal. Then, resulting audio signals are presented to listeners multiple times and ratings are collected time-discretely (one rating per result audio signal) as shown in the Table 2.

Experiment results are shown on the Fig. 5.

Signal	Neural Network	Weights	Signal	MOS	Results
Signal-1	Pretrained CNN for image style conversion.	Pretrained VGG-19	Parallel	1.7	Not clear with lot of background noise.
Signal-2	Gram matrix CNN with random weights.	Random weights	Parallel	4.3	Clear results in the male to female conversion.
Signal-3	Pretrained CNN for image style conversion.	Pretrained VGG-19	Non-parallel	1.1	Not clear with a lot of background noise.
Signal-4	Gram matrix CNN with random weights.	Random weights	Non-parallel	1.3	Not clear. We get only mixture of the signals. There is no style transformation.

Table II. SIGNAL QUALITY EVALUATION

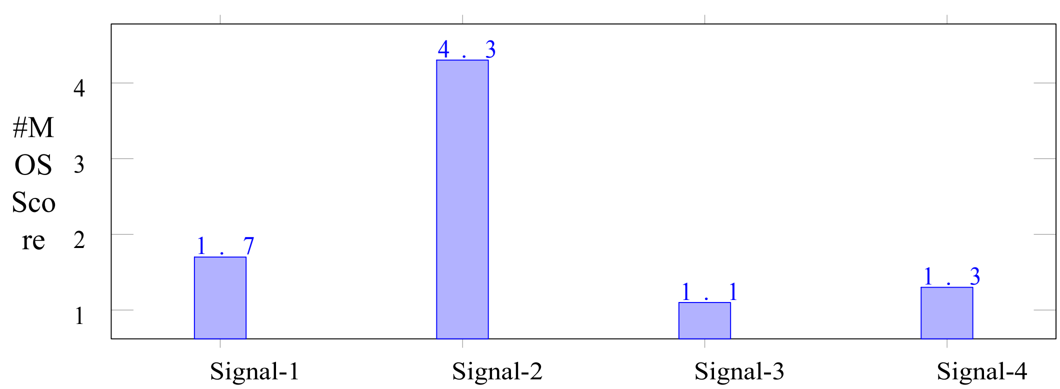

Figure 5. MOS rating values

From the Figure 5 we can see that VGG-19 network model may not suitable to process the audio signal with one-dimensional content because it understands three-dimensional convolution. Also, we conclude that results in non-parallel approach are not acceptable. We believe that neural style transfer model which implemented CNN architecture able to extract feature and style transfer for images as CNN architecture is built to recognize image properties because it convoluted in three dimensional.

Overall, we can conclude that usage of Neural network models for the image transfer style to transfer style of audio need to be extended with different approaches like phonemes analysis.

VI. CONCLUSION

In this paper, we prove concept that CNN model for the image style transformation can be applied for a voice style transfer. We present novel data preparation and audio signal transformation process. In the first phase of the experiment, we use pre-trained VGG-19 network model. We conclude that because of one-dimensional nature of the audio signal, the pre-trained network model for object recognition cannot be used for the audio signal conversion. In the second phase of experiment, we conclude that voice style conversion based on the gram matrix CNN with random weights is able to produce a good result only for parallel approach. Based on experiment results, we can conclude that audio signals should not be represented as an image as image processing algorithms tends to update input audio signals based on the correlations in the extracted image features. In the future research we will do experiments with pretrained speech recognition models to extract speech style features.

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Decision Making Methodology TOPSIS for Selecting the Most Ideal Mobile Phone

M. Radovanović*, J. Pavlović*, V. Nikoić**, A. Jašić***, A. Kostić Zobenica****
* The University of Criminalistic and Police Studies, Belgrade, Serbia
** MoI RS, Ministry of Interior Republic of Serbia, Beograd, Serbia
*** University of Novi Sad, Technical Faculty Mihajlo Pupin, Zrenjanin, Republic of Serbia
**** University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia

Abstract - Multi-criteria decision making is a very valuable tool, which can be used to make very complex decisions. Its most common application is in solving problems where the choice between several offered alternatives should be made. The purpose of multi-criteria decision making is to help decision makers who are faced with such problems. Within this work, you will be presented in detail and explained the mathematical model of the TOPSIS method, as well as one of its application examples.

I. TOPSIS

Technique for Order of Preference by Similarity to Ideal Solution.

This method ranks alternatives at a distance from the ideal and negative ideal solution. The optimal alternative is the one closest to the ideal solution, or the longest of the ideal negative solution. Ranking is based on "relative similarity to an ideal solution," which avoids the situation that the alternative has the same similarity at the same time with an ideal and negative ideal solution. The ideal solution is defined using the best value for the rating of alternatives for each individual criterion; On the contrary, the negative ideal solution represents the worst value of an alternative rating. The best and worse terms are assigned to each criterion separately, according to whether it is a maximization or minimization of criteria.

This method consists of 6 steps:

1. Normalization of the matrix
2. Weight normalization of the matrix
3. Determination of ideal solutions
4. Determination of Euclidean Distances an alternative to ideal solutions
5. Determining the relative proximity of the alternative to the ideal solution
6. Ranking alternatives.

A. Normalization of the matrix

It comes in the formula:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{k=1}^{m} x_{kj}^2}}, i = 1,2,\ldots,m, j = 1,2,\ldots,n$$

Where r_{ij} a normalized matrix element located in the i-th column and the j-th row, and X_{ij} is the input matrix element, which is also located in the i-th column, and the j-th row.

B. Weight normalization of the matrix

It comes in the formula:

$$t_{ij} = r_{ij} \cdot w_j, i = 1,2,\ldots,m, j = 1,2,\ldots,n$$

By multiplying each matrix element with the weight for that criterion.

Where W_j = the weight coefficient of the criterion, and has them as much as the criteria, since each weight coefficient is in charge of a particular criterion.

C. Determination of ideal solutions

It comes in the formula:

$$A_w = \{\langle max(t_{ij}|i=1,2,\ldots,m)|j \in J_-\rangle, \langle min(t_{ij}|i=1,2,\ldots,m)|j \in J_+\rangle\} \equiv \{t_{wj}|j=1,2,\ldots,n\},$$

$$A_b = \{\langle min(t_{ij}|i=1,2,\ldots,m)|j \in J_-\rangle, \langle max(t_{ij}|i=1,2,\ldots,m)|j \in J_+\rangle\} \equiv \{t_{bj}|j=1,2,\ldots,n\},$$

$$J_+ = \{j = 1,2,\ldots,n|j\}$$

$$J_- = \{j = 1,2,\ldots,n|j\}$$

Where A_w worst solution, A_b best solution, a J_+ i J_- represent criteria with a positive or negative effect. In other words, when determining the worst solution, in the criteria with a negative impact, we choose to increase the value, while in the criteria with a positive influence, the value is as small as possible. When determining the best solution, it is the other way around.

D. Determination of Euclidean Distances an alternative to ideal solutions

It comes in the formula:

$$d_{iw} = \sqrt{\sum_{j=1}^{n}(t_{ij} - t_{wj})^2}, i = 1, 2, \dots, m,$$

$$d_{ib} = \sqrt{\sum_{j=1}^{n}(t_{ij} - t_{bj})^2}, i = 1, 2, \dots, m$$

Where d_{iw} the distance of the i-th alternative from the worst solution A_w, and d_{ib} the distance of the i-th alternative of the best solution A_b.

E. Determining the relative proximity of the alternative to the ideal solution

It comes in the formula:

$$s_{iw} = d_{iw}/(d_{iw} + d_{ib}), 0 \leq s_{iw} \leq 1, i = 1, 2, \dots, m \; .$$

S_{iw} will be 1 if and only if this alternative is the best solution, and 0 if and only if this alternative is the worst solution.

F. Ranking alternatives

It occurs in relation to the values S_{iw} , the best one is the with highest value and the worst with the smallest value.

II. APPLICATION EXAMPLE

Choosing the most ideal mobile phone.

Initial matrix of decision making:

	Price (din)	Battery (mAh)	Internal memory(Gb)	RAM memory(Gb)	Front camera(MP)
Wj	0.058	0.276	0.151	0.288	0.193
a request	min	max	max	max	max
SAMSUNG Galaxy Note 9	84600	4000	128	6	8
HUAWEI P Smart 2019	10200	3400	64	3	8
BLACKBERRY Key 2	61200	3500	64	6	8
SAMSUNG Galaxy S10	88200	3400	128	8	10
HONOR 20 Lite	24600	3400	128	4	32

1. We carry out the normalization of the matrix in order to obtain the values of the alternatives in the range of 0 to 1, and then multiplying the weight coefficients of the criteria in order to obtain a weighted normalized matrix.

	Price	Battery	Internal memory	RAM memory	Front camera
Wj	0.058	0.276	0.151	0.288	0.193
a request	min	max	max	max	max
SAMSUNG Galaxy Note 9	0.03647	0.14406	0.08355	0.14097	0.04405
HUAWEI P Smart 2019	0.00439	0.12245	0.04177	0.07048	0.04405

BLACKBERRY Key 2	0.02638	0.12605	0.04177	0.14097	0.04405
SAMSUNG Galaxy S10	0.03802	0.12245	0.08355	0.18797	0.05507
HONOR 20 Lite	0.01060	0.12245	0.08355	0.09398	0.17623

2. We determine the best and worst possible solutions, the best alternatives are those that have the highest values in relation to the criteria that are maximized and at least for the criteria that are minimized.

	Price	Battery	Internal memory	RAM memory	Front camera
a request	min	max	max	max	max
A_b	0.00439	0.14406	0.08355	0.18797	0.17623
A_w	0.03802	0.12245	0.04177	0.07048	0.04405

3. We determine the euclidean distances of all alternatives from the ideal and ideal negative solution.

phone type	d_{ib}	d_{iw}
SAMSUNG Galaxy Note 9	0.14390	0.08475
HUAWEI P Smart 2019	0.18299	0.03363
BLACKBERRY Key 2	0.14910	0.07153
SAMSUNG Galaxy S10	0.12758	0.12517
HONOR 20 Lite	0.09663	0.14325

4. We determine the relative proximity of an alternative to an ideal negative solution. For each alternative, the relative distance is calculated (S_{iw}). The alternative is closer to the ideal solution if S_{iw} is closer to the value of 1, or in other words, if S_{iw} is closer to 0, it is closer to the ideal negative solution.

phone type	S_{iw}
SAMSUNG Galaxy Note 9	0.37065
HUAWEI P Smart 2019	0.15525
BLACKBERRY Key 2	0.32421
SAMSUNG Galaxy S10	0.49522
HONOR 20 Lite	0.59715

5. We are ranking the alternatives by decreasing values, and finally the solution looks like this.

phone type	S_{iw}	the most ideal mobile phone
HONOR 20 Lite	0.59715	1
SAMSUNG Galaxy S10	0.49522	2
SAMSUNG Galaxy Note 9	0.37065	3
BLACKBERRY Key 2	0.32421	4
HUAWEI P Smart 2019	0.15525	5

III. CONCLUSION

In practice, there are many methods of multi-criteria decision making. Many of them use different ranking processes and for this reason we can get different ranks for the same alternatives. What separates the TOPSIS method from others is that it has a simple process and can be easily implemented in some software, it also has the ability to consider an unlimited number of criteria and alternatives in the decision making process.

In this paper, we could see the practical application of the TOPSIS method for selecting the most ideal mobile phone. In relation to the set criteria, the methods ranked the alternatives to the distance from the ideal solution and calculated the most ideal choice for us.

In this work we made a choice between the phones: SAMSUNG Galaxy Note 9, HUAWEI P Smart 2019, BLACKBERRY Key 2, SAMSUNG Galaxy S10, HONOR 20 Lite. According to the calculations of this method, the most ideal phone for us is HONOR 20 Lite.

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Possibilities of Using Simplex Methods in Information Systems for Decision Support

K. Nicović*, A. Stevović**, V. Nikoić*,**, A. Jašić***, V. Premčevski***
*The University of Criminalistic and Police Studies, Belgrade, Republic of Serbia
**MoI RS, Ministry of Interior Republic of Serbia, Beograd, Republic of Serbia
***University of Novi Sad, Technical Faculty Mihajlo Pupin, Zrenjanin, Republic of Serbia

Abstract - When it comes to multi-criteria decision making, multi-cell and simplex methods, there is often a problem. The problem of decision-making is when there are more conflicting criteria in some situations. In this paper, the topic of multi-criteria decision making, multi-cell and simplex methods will be elaborated through a concise review of the model of multi-criteria analysis, and criteria, alternatives and attributes will also be considered. This work also includes one-criterion optimization, and a simplex table will be summarized. What is important to note is that this paper focuses on the simplex application, which is explained on the example. Simplex applications significantly help solve some of the problems in the business decision making process.

I. INTRODUCTION

Methods of multi-criteria analysis, or multidimensional decision-making, as elsewhere in the literature refer to this set of methods, refer to decision-making problems in situations where there are multiple, often conflicting criteria. This type of problem is often common in both daily life and business decision-making, as well as in important state issues such as development, defense, budget planning.

The development of multi-criteria analysis, as a scientific discipline, is closely related to the development of computer technology. On the one hand, the rapid development of computer technology in recent years makes possible a systematic analysis of complex problems of multi-criteria analysis. On the other hand, the widespread use of computer and information technology has generated a large amount of data, making multi-criteria decision-making models extremely important and helpful to the business decision-making process.

II. DEFINING THE PROBLEM AND STRUCTURE OF THE MULTI-CRITERIA ANALYSIS MODEL

Multi-criteria analysis methods are directed to solving the problem of choosing one of the series *m* of the alternative *Ai (i = 1, 2, ..., m)* based on the n criterion *Xj (j = 1, 2, .. ., n)*. Each of the alternatives is vector *Ai = (xi1, xi2, ..., xij, ..., xin),* where *xij* is the value of the *j-th* of the attribute for the *i-th* alternative. The usual way of presenting the problem of multi-criteria analysis is a matrix form. Creating a multi-criteria analysis model implies the existence of relevant knowledge of possible alternatives for implementing the process for which the decision is made, the goals that the decision-maker wants to achieve, as well as the data on how each of the available alternatives contributes to achieving a particular goal.

***Criteria*:** The criteria in the model are represented by an appropriate function, and their significance is expressed by the corresponding weight coefficient. Depending on the type of extreme value of a function of criteria that is in accordance with the interests of the decision maker, we distinguish two types of criteria.

The first group consists of criteria where the interest of the decision maker is to achieve the maximum value of the function of the criterion, such as maximizing profit, revenue, efficiency, etc. The second group consists of criteria where the interest of the decision maker is to achieve the minimal value of the function of the criterion, such as the minimization of costs, prices, expenditures, etc. The importance that the criteria will have in the model directly depends on the preference of the decision maker, or the weight coefficient that the decision-maker will assign to a particular criterion.

***Alternatives*:** Alternatives in the model form a set with a finite number of elements that need to be tested, evaluated, set priorities, and finally make a selection, or ranking. Essentially, the alternative is the possible way of acting of the decision-maker, and depending on the problem, synonymous for "alternative" could be, among others, "option", "action", "strategy", "politics", "candidate" etc.

Attributes: There is some kind of inaccuracy in defining the concept of attributes in relation to the notion of criteria, both in domestic as well as in foreign literature. What all authors agree is that the attribute is traits, quality or characteristics of the alternative according to the criterion observed. Precisely because it represents the level of achievement of the criteria, one can find the opinion that the "attribute" is synonymous with the "criterion". At the level of the alternative, that's exactly what it is. However, at the level of the whole problem, where there are m alternatives and n criteria, the term attribute is used in terms of the characteristics of the alternative for each of the criteria, and each criterion is defined with m different attributes representing the degree of success of the alternative for the observed criterion. So, if we look at the matrix form that defines the problem of multi-criteria analysis, the attribute is the coefficient xij, and not the criterion Xj. In this context, the synonyms "attribute" would be "parameter", "performance", "component", "factor" ...

One-criterion optimization: The problem of single criterion conditional optimization involves the formation of a mathematical model consisting of the function of the criterion f (x), which determines the minimum or maximum value, and the set of constraints gi (x) ≤0 with m restrictions, where x is a vector unknown with n unknowns, x = { x1, x2, ..., xn}, whose characteristic is that its components can not be negative, but positive or zero (xj≥0, j = 1,2, ... n).

The general mathematical model with one function of the criteria has the following form:

$$f(x)$$

$$g_i(x) \leq 0, \; i=1,2,..m$$

$$x \geq 0$$

Depending on the nature of the relation for the function of the criteria and constraints, linear models (all relations are linear) or nonlinear models (at least one relation is a nonlinear form). The general record of the linear model with one criterion and with the requirement to determine the maximum value of the criterion has the form:

$$\{\leq b_i \qquad i=1,2,..m$$

$$\{= b_i \qquad i=m_1+1, m_1+2, \ldots m_1+m_2$$

$$\{\geq b_i \qquad i=m_1+m_2+1, m_1+m_2+2, \ldots m_1+m_2+m_3$$

$$j=1,2,\ldots n.$$

$$(\max)\; f(x)=\textstyle\sum_j c_j x_j$$

$$\textstyle\sum_j a_{ij} x_j$$

$$x_j \geq 0$$

Where are:

n- number unknown, j = 1,2, .. n;

m- number of constraints m = m1 + m2 + m3, where there may be certain numbers (m1, m2, m3) of constraints with signs ≤ (not greater, less or equal) = (equal) and ≥ (no less, greater or equal) , respectively, i=1,2,...m;

f(x)-the criterion function;
cj-coefficient in the function of the criterion for j unknown, j = 1,2, ... n;
aij- coefficient in the ith restriction of j-th unknown, i = 1,2, ... m; j = 1,2, ... n;
bi-free member in the i-th constraint, i = 1,2, ... m;
xj - unknown size at the jth place in the order of the ordering, j = 1,2, ... n;

Simplex table: The Simplex table represents a tabular way of showing a linear programming problem that is adapted for solving these problems using the simplex method. A table view allows for the optimal solution of linear programming in a series of iterations, in which the solutions are represented by the corresponding simplex tables. The initial basic solution is represented by an initial, initial simplex table that represents the starting basis for determining the optimal solution. In Figure 1 you can see the initial simplex inequalities that allows us to create an initial simplex table.

$$(\max)Z = c_1x_1 + c_2x_2 + \ldots + c_px_p$$
$$a_{11}x_1 + a_{12}x_2 + \ldots + a_{1p}x_p \le b_1$$
$$a_{21}x_1 + a_{22}x_2 + \ldots + a_{2p}x_p \le b_2$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$a_{m1}x_1 + a_{m2}x_2 + \ldots + a_{mp}x_p \le b_m$$
$$x_1, x_2, \ldots, x_p \ge 0$$

***Figure 1**: Simplex inequalitie*

III. SIMPLEX APPLICATION:

Appearance of the application (Figure 2):

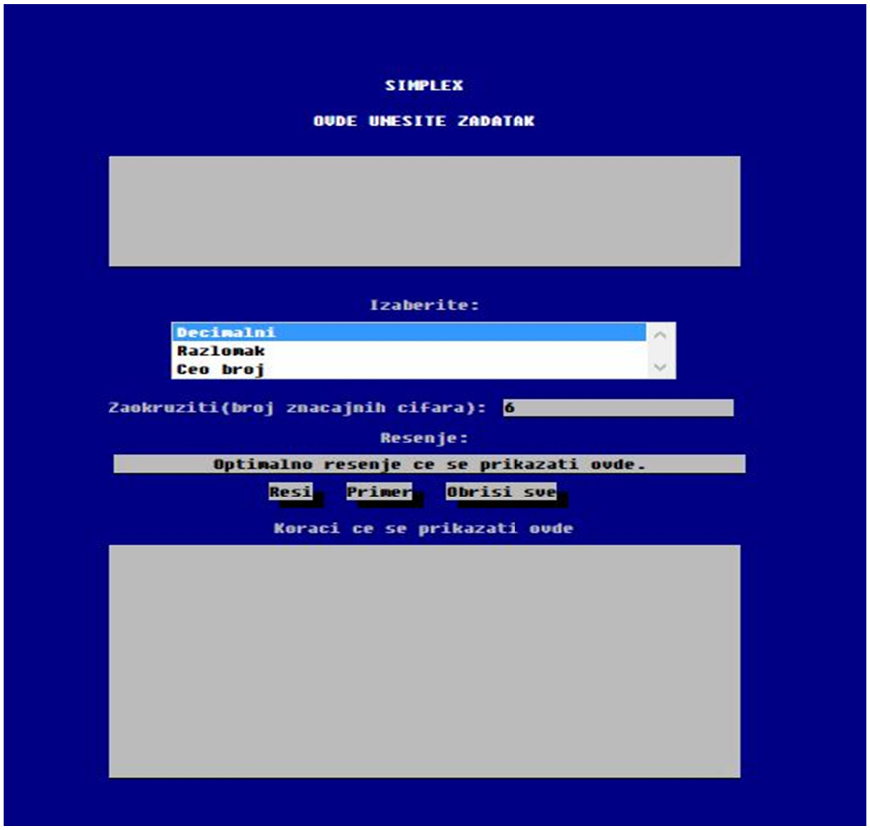

***Figure 2**: Simplex application*

USED TEHNOLOGIES:

- HTML
- CSS
- Java Script

The application runs using the browser.

Example:

In order to best show the way the application works, we will use the inequalities of the following example (Figure 3), only instead of x1 we will write x, instead of x2 we will write y, and instead of x3 we will write z.

$$\max F(x) = 10x_1 + 12x_2 + 10x_3$$
$$4x_1 + 5x_2 + 4x_3 \le 4200$$
$$2x_1 + 2x_2 + x_3 \le 1500$$
$$2x_1 + 3x_2 + 4x_3 \le 2400$$
$$x_1 \ge 0, x_2 \ge 0, x_3 \ge 0$$

Figure 3: Example

The way in which inequalities are entered (Figure 4):

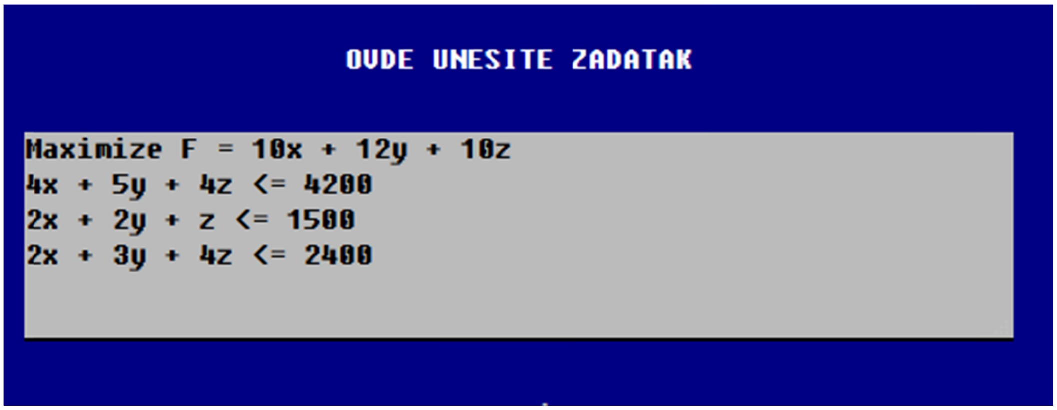

Figure 4*: The method of entering the inequalities in the Simplex application*

After entering inequalities, we choose whether we are working with an integer, a decimal number, or a fraction, and on how many significant numbers we want to complete the numbers in the task as shown in Figure 5.

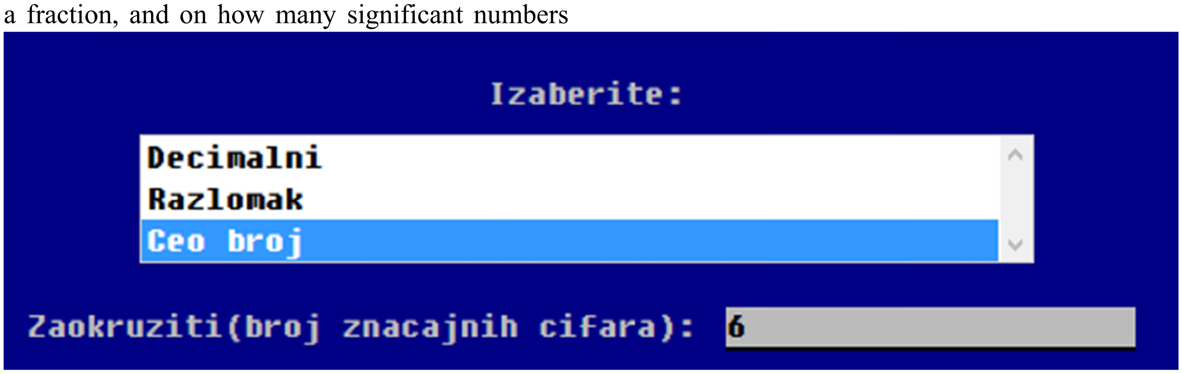

Figure 5*: Choosing type of number and number of significant digits*

When the task is entered and the selected options are clicked on the "Solution" button, the optimal solution is shown, as well as the steps for the optimal solution (Figure 6 and Figure 7).

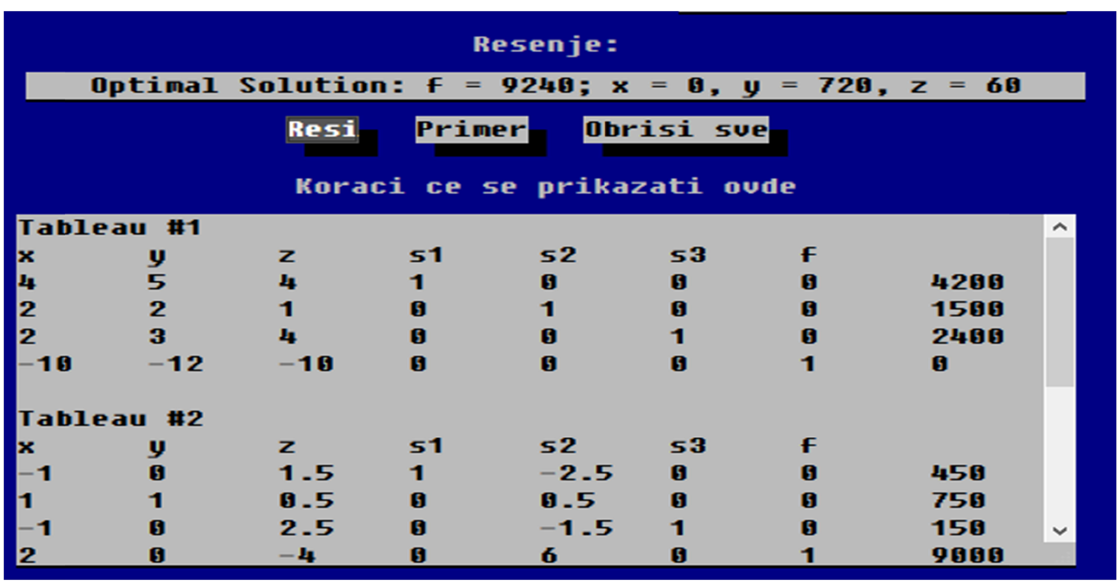

Figure 6*: Optimal solution and steps*

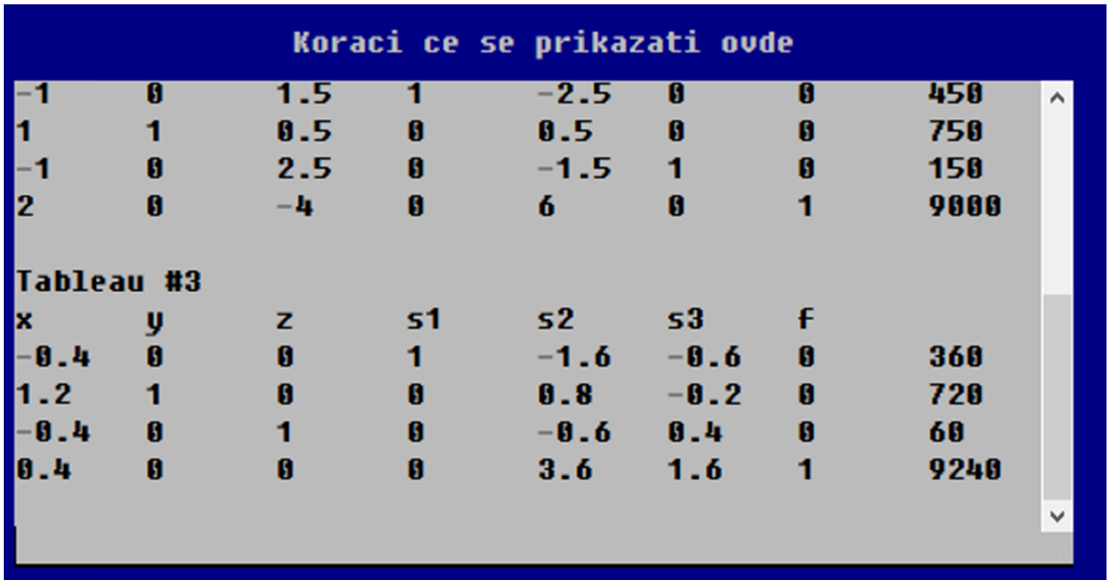

***Figure** 7: Steps that lead us to the solution*

IV. CONCLUSION

Decision making is a process that is continuously taking place everywhere and by everyone. Community representatives (authorities) make decisions that concern not only the decision maker - but the whole community: decisions on building schools and roads, afforestation, opening a mine or building a factory, restoring religious temples, holding a festival of folk creativity. In business, messengers make decisions about the prices of their products, a combination of available resources, the choice of workers for specific jobs and / or rewards and savings. There are several solutions for the greatest number of cases or problems that are solved. For this to be the best (compromise) solution - and in search of it, in the last five to six decades, methods for supporting decision-making of this type have been developed, the so-called multi-criteria decision-making methods (MCDA and MCDM). For these purposes, a number of methods have been developed, which have been developed in academic scales, but also applied in practice.

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Gamification of Learning and Education

D. Milanov*, I. Palinkaš*, E. Terek*, J. Bushati **
* University of Novi Sad, Technical faculty Mihajlo Pupin, Zrenjanin, Republic of Serbia
** University of Shkodra "Luigj Gurakuqi", Albania
dusanka.milanov@tfzr.rs

Abstract – Gamification is a concept that can be applied in various areas but with upcoming generations of digital learners, it has become very important in education and learning. The aim of this paper is to explain what the term itself means in the area of education, how it can benefit teachers and students as well as to point out its benefits and possible faults. This is going to be done by reviewing available literature sources and some game-based concepts that are already being used in classrooms for years.

I. INTRODUCTION

Gamification is not a new concept, it has been around for years and used for different areas of science, marketing, industry etc. Gamification has most frequently been used as a clever way to promote a business or product. For instance, players can earn badges, discounts, and other rewards for visiting real-world shops and "checking-in" to the mobile phone application FourSquare. Games that are designed to promote positive lifestyle changes are starting to appear as well. Chore Wars and EpicWin encourage players to complete daily chores, while websites like Google Powermeter can encourage household reductions in energy consumption through the use of progress bars and collectible badges [6]. Its popularity grew in time and it was only natural for teachers to start using it in the classroom as well.

Many schools around the world are facing the crucial problem and that is students' motivation and their engagement in the learning process. With including the elements of gaming into non-game contexts gives the opportunities to schools and universities to deal with these hard to solve problems.

Teachers are facing new challenges and have to solve important questions related to adaptation of learning according to student needs and demands, which have changed over the years, as technology and availability of information and communications technologies grew. Teachers have to use different teaching methods and approaches, with modern teaching trends, to create conditions that allow students to be active participants with strong motivation.

II. GAMIFICATION IN EDUCATION

A. *Definition*

According to Werbach and Hunter (2012), gamification is defined as the use of game elements and game design techniques in non-game contexts. It is based in the success of the gaming industry, social media, and decades of research in human psychology. Basically, any task, assignment, process or theoretical context can be gamified [7]. The main objective of gamification, in educational environment, would be to increase the participation of a student during class and learning process and provide motivation by integrating game elements such as prizes, badges and awards.

According to Kapp gamification is "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems." [4].

Gamification is the use of game thinking, approaches and elements in a context different from the games. Using game mechanics improves motivation and learning in formal and informal conditions (GamifyingEducation.org). Various definitions overlap and can be summarized as follows: Gamification is an integration of game elements and game thinking in activities that are not games.

Although the term "gamification" was coined in 2002 by Nick Pelling, a British-born com-puter programmer and inventor, it did not gain popularity until 2010. Gamification has been defined as the process of using game thinking and mechanics to engage audiences and solve problems as using game techniques to make activities more engaging and fun and as using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems [4]. Others have also defined it as" the use of game mechanics, dynamics and frameworks to promote desired behaviors" [6] as well as "the use of game-play mechanics for non-game applications" [1].

B. Five-step model for educational gamification

When specifically education is observed, a 5-step model for gamifying learning process can be offered [3]:

1. Understand the target audience and the context,

2. Define learning objectives,

3. Structure the experience,

4. Identify resources,

5. Apply gamification elements.

The first two steps are basic to educational design where also pinpointing student trouble spots will help determine the best gamification strategies. Learning goals include helping students understand concepts and develop skills. Part of that is also setting behavior goals which involve helping students concentrate and work efficiently. Learning objectives determine what educational content and activities to be included in learning process and selection of appropriate game mechanisms and techniques to achieve them.

Structuring the experience includes creating the stages and milestones, as well as modifying how grades are being presented, with highlighting progress instead of mistakes. Identifying resources includes having manuals, organizing teams, explaining what students must do to succeed in a gamified learning environment. Gamification elements are for example badges, levels, time constraints, reward points. These elements should also include social part of learning, like making progress visible, which can promote a sense of student community.

C. Gaming elements in learning

When wanting to use game-like environment in learning, it is important for students, similar as for gamers, to have a certain status amongst other students. This can be achieved by a reward system that involves points or badges that show the players 'status'. Games also use "levels", as an easily understandable and clear path of progress through increasing difficult and demanding better improved skills for each level. Individuals like to progress from one level to the other and this is what could improve student participation and motivation. But it also must be made clear what that progression is. There is always a large reward at the end of the game, but there are numerous milestones that mark the progress of each individual towards that larger goal. One of the important elements of games that work well in learning is competition where statistics and rankings can be used in order to allow the player to judge performance. Having 'status' is not enough unless it can be communicated to colleagues and society. This can be achieved through leaderboards. Individuals typically strive to have their names up on these boards. This can be a great motivational factor as it allows the learner to check out each other's performance using a kind of social connection that must be provided within a learning environment which also allows sharing in a limited way.

The following are elements and principles that can drive gamification in learning [9]:

- Provide ways for users to show 'status',
- Provide a way for users to compare and rank their relative performance,
- Provide clear levels for user progression,
- Include elements that encourage competition,
- Provide digital immersion to the best extent possible,
- Allow for sharing and personalization.

The key element of gamification is the inclusion of tasks that learners have to perform. The performance of tasks leads to accumulation of points, transition to higher levels, and winning awards. All these actions are aimed at achieving predetermined learning objectives. Which elements will be included in training depends on the defined objectives (what knowledge and skills should be acquired as a result of the task). Activities that require independent work by students bring individual awards (such as badges). Activities requiring interaction with other learners are the social element of training, they make students a part of a big learning community and their results are public and visible (such as leaderboards) [3].

On the other hand, according to Sailer, Hense, Mandl and Klevers (2013), video games follow a design pattern, which integrate certain elements or components. This is crucial at the time of designing a game and it’s essential towards the main objective of gamification, which is motivation. Some of these components include: points, badges, leaderboards, progress bars/progression, performance graphs, quests, levels, avatars, social elements, and rewards/rewards system. They are defined as follows:

1. Points: Numeric accumulation based on certain activities.
2. Badges: Visual representation of achievements for the use has shown online.

3. Leader boards: How the players are ranked based on success.
4. Progress bards/Progression: Shows the status of a player.
5. Quests: Some of the tasks have to fulfill in a game.
6. Levels: A section or parts of the game.
7. Avatars: Visual representation of a player or alter ego.
8. Social elements: Relationships with other user through the game.
9. Rewards/rewards system: System to motivate players that accomplish a quest.

III. Benefits and criticism

Games motivate because of their impact on the cognitive, emotional and social areas of players; therefore gamification in education should focus on those three areas. Gamification can motivate students to engage in the classroom, give teachers better tools to guide and reward students, and get students to bring their full selves to the pursuit of learning. It can show them the ways that education can be a joyful experience, and the blurring of boundaries between informal and formal learning can inspire students to learn in lifelong ways [6].

Gamification makes learning fun and research has shown that gamification in schools can help students with issues related to:

- Focus — Students who have a hard time focusing may find it easier when tackling an engaging topic.
- Skill-Building — Students can shy away from building certain skills until they see the relevancy.
- Content Delivery — Students may have trouble processing content presented through traditional methods, such as textbooks.

The challenges, however, are also significant and need to be considered. Gamification might absorb teacher resources, or teach students that they should learn only when provided with external rewards. On the other hand, playfulness requires freedom - the freedom to experiment, to fail, to explore multiple identities, to control one's own investment and experience [5]. By making play mandatory, gamification might create rule-based experiences that feel just like school.

A literature review of gamification studies done mostly in higher education institutions by Dicheva, Dechev, Agre, & Angelova (2015) found that most of the papers they reviewed showed encouraging results. When it comes to learning activities, increased attendance, and lowering the gap between the highest and lowest scorers, the studies showed positive results. Studies with mixed results, positive and negative, didn't include critical motivational elements or weren't carried out properly because educators didn't have enough time or interaction with learners was low.

IV. Conclusion

Gamification has shown that it can be a valuable addition to designing effective learning. Students tend to like it, and in certain circumstances, it can motivate and improve learner performance. The key is in the way that gameful design – gamification – is incorporated into a lesson or a class. It has to be taken into consideration that finding new ways of applying gamification to learning contexts that are not limited to rewards like achievements and badges and that are more meaningful to students is very important for increasing the application of this emerging technology in education.

As gamification spreads throughout the real world, there is little question it will also impact schools. Teachers and educators have to ensure that the impact of gamification is a positive one. Gamification will be a part of students' lives for years to come.

Gamification, when done correctly can have a measurable effect on learning, overall skill acquisition, and knowledge transfer, because it incents timely course completion with satisfactory scores and therefore, results. It can have a great emotional and social impact on students, as reward systems and competitive social mechanisms seem to be motivating for them. Reward systems suppose an innovative, fun and encouraging way to represent progress within an online educative experience. Leaderboards also serve as a source of motivation because students see their work publicly and instantly recognized, and because they can compare their progress with other classmates. Immediate feedback will increase students' motivation thus leading them to have better results [4].

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The Evolution of Blockchain Technology

N. Simić, D. Lacmanović, V. Premčevski
University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
novak.simic21@gmail.com, dlacman@yahoo.com, velci.aspire@gmail.com,

Abstract – Blockchain represents a growing list of records, called blocks, which are linked throughout cryptography. Each block contains a cryptographic hash values of the previous block a timestamp, and transaction data. Blockchain is resistant to a modification of the data, so it is distributed ledger that can record transaction between two parties efficiently and in a verifiable and permanent way.

I. INTRODUCTION

Blockchain is distributed without central repository and usually without central authority, which is the key principle of this technology. It has the potential to seriously alter the economy we know today. Blockchain brings new concept that embraces new technological developments and shift the power from one to many, or from central concept to distributed one. On their basic level, they enable a community of users' record transaction in shared ledger within their community. Bitcoin represent the most popular example that is tied to blockchain technology. Cryptocurrencies are the first real application of the blockchain, but there is new potential areas emerged such as distributed storage, smart contracts etc. which extend functionality of the blockchain and open doors for the new breakthroughs.

II. II BLOCKCHAIN ARCHITECTURE

1. Blockchain

The data in the blockchain (e.g .transaction) is divided into blocks.[1] Each of this blocks is dependent on the previous one. The blockchain serves as the database comprises of nodes or workers. These workers or nodes are responsible for appending after new blocks is added to the blockchain. One of the features of the block is that it can be appended after all nodes in the system reach a consensus, i. e all agree that this block is legit and contains only valid transaction. Validity of the transactions and computing of new blocks are determinated by the protocol. Blockchain is shared among all nodes in the system, and it is monitored by every node and at the same time controlled by none [1]. The protocol itself has responsibility to keep the blockchain valid.

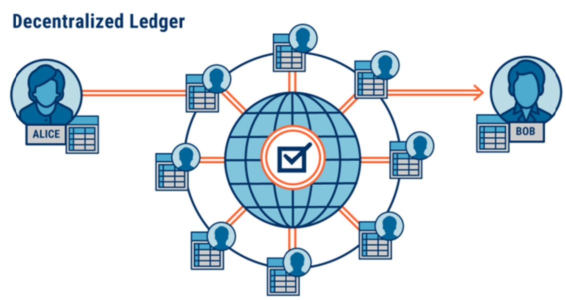

Figure 1. Decentralized ledger

1. *Protocol*

The protocol regulates how the blockchain is used for specific purpose. In cryptocurrency, it represents software that transfers the money between two parties in the system. In addition, protocol is one thing whom the users trust in the system. Since the protocol is completely transparent to all users in system, everybody can analyze it and check if it actually performs the intended task.

2. *Currency*

Represent the currency itself e.g Bitcoin, Litecoin, Peercoin, etc. [1]. When every user want to use any of these currencies (which are just hashes in the system), the protocol has to be followed and blockchain architecture is used as an underlying database where any transaction between two parties is stored. Every change of ownership is marked in the blockchain and it can be traced back until coin is created, because every new coins are determined by the protocol. Coin must be in the blockchain, so that anyone can check if person possesses a specific coin from somebody or not. In addition, blockchain does not allow to double-spend the coin, because every change is written in the block. It is much like regular currency Bitcoins are decomposable into smaller units.

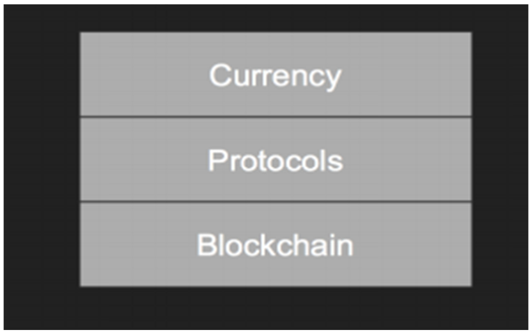

Figure 2. Blockchain success rate

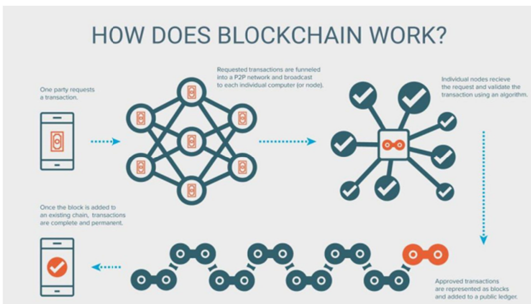

Figure 3. .Blockchain success rate

A. *Key characteristics of Blockchain*

Blockchain has following characteristics.

- **Decentralization.** In conventional centralized transaction systems, each transaction between parties needs to be validate through central trusted agency (for e. g central bank). Third party in transaction is no longer needed in blockchain. Consensus algorithms in blockchain are used to maintain data consistency in distributed network [2].
- **Persistency.** All transactions can be validate very quickly and transactions that are invalid will not be admitted by the miners. In Blockchain it is nearly impossible to delete or rollback any transaction once they are included in system.
- **Anonymity.** Users are identified by the generated address in Blockchain system, which does not reveal true identity of user. Blockchain cannot guarantee the perfect privacy preservation.
- **Auditability.** Bitcoin blockchain stores information about users balances which is based on Unspent Transaction Output (UTXO) model. Any of the transaction must refer to some previously unspent transaction.

B. *Bitcoin*

Bitcoin represents the first decentralized cryptocurrency in the world and largest of its kind on the market value of its term. It becomes a revolution in 2009, because it introduced peer-to-peer transactions without the need of and intermediary of parties. Parties in the transaction do not need to trust each other but they trust the system (protocol) which comprises of decentralized nodes that verify and validate the transaction. Fortunately, Bitcoin only relies on a handful of relatively simple and well• known cryptographic constructions [6].

The main parties in the Bitcoin protocol are:

- Sender: the one who initiates the transfer of currency.
- Receiver: the recipient of the transfer
- Miners: Independent nodes that verify and confirm the transactions.
- Blockchain: Decentralized ledger shared among all miners.

The system has following characteristics:

- Decentralized: The work is done by miners who are located around the world.
- Pseudo-Anonymous: Users are identified via public keys in the system and there is no way to know to whom the public key belongs unless it is made public by the owner of the key.
- The first currency with no bank and/or nation behind it to organize and maintain it [8].

Types of Blockchain	Example of Blockchain	Consensus Algorithm	Nature
Public Blockchains	Bitcoin, Ethereum, Litcoin etc	PoW, PoS, DPoS	Open and decentralized
Federated Blockchains	R3, B3I, EWF	No	Controlled and Restricted
Private Blockchains	Company Internal	PBFT, RAFT	Restricted
Permisioned Blockchain	Hyperledger, Ripple	PBFT	Closed and restrcited

Figure 4. Comparation between the main difference types of state persistence

III. CONSESUS ALGORITHM

To reach consensus among untrust-worth nodes in blockchain is transformation of Byzantine Generals (BG) problem that is presenting in system. All algorithms ultimately rely on message passing, and the recipients take actions based on the contents of the received messages [10]. In blockchain system there is no central node that ensure ledgers on distributed nodes are all the same. There needs to be several protocols to ensure ledgers in different nodes are consistent. There are following several common approaches to reach consensus in blockchain.

A. Approaches to consensus

PoW (Proof of work) is a consensus strategy that is used in Bitcoin network. There must be someone to record the transaction in decentralized network. Easiest way is to pick random selection, but it is vulnerable to attacks. In PoW, each node of the network is calculating a hash value of the block header [2]. Any number of participants could publish proposals for state transition. Participants accept a state transition as soon as a solution has been validated by the workers. As soon as participants discover a solution to a given problem, they publish their proposed state transition along with this solution [3]. The proof of work (PoW) consensus mechanism is the widest deployed consensus mechanism in existing blockchain [5].

PoS (Proof of stake) is representing energy-saving alternative to PoW. Miners' task is to prove the ownership of amount of currency. Selection based on account balance is quite unfair because richest person is bound to be dominant in the network. Many solutions are provided with combination of the stack size to decide which one to forge next block. Solution uses randomized algorithm to predict the next generator. The concept by which proof-of stake consensus is determined very closely mirrors that of proof-of-work [3].

DPOS (Delegate proof of stake). The difference between PoS and DPOS is that PoS is direct democratic while DPOS is representative democratic. Stakeholders elect their delegates to generate and validate blocks in system. With fewer nodes to validate the block, the block can be confirmed very quickly, leading to quick confirmation of transaction.

Ripple represents consensus algorithm that utilizes collectivity-trusted subnetworks within the larger network. In the network, all nodes are divided into two types: server for participating consensus process and client for transferring funds. On server type, each of the servers has Unique Node List (UNL), which is very important to the server.

IV. PROS AND CONS OF BLOCKCHAIN TECHNOLOGY

A. The advantages of Blockchain technology

The main benefit of this technology is that blockchain is decentralized system. It means that the system works without intermediary and all participants of this Blockchain make the decision [4]. Blockchain has its own proof of validation and authorization to enforce the constraints. Each action is recorded to Blockchain data of records so that every participant can access them, and cannot be changed or deleted. Distributed ledgers make proving the ownership of a digital asset more like performing a real property title search.[7] The benefit makes Blockchain technology unalterable and indestructible [4]. The high security in Blockchain technology is achieved on the individual entry into the network, because each person is provided with unique identity that is linked to his account.

B. The disadvantages of Blockchain technology

The main disadvantage of the Blockchain technology is the high-energy consumption. The signature verification is the challenge of the Blockchain, because each transaction must be sign with cryptographic scheme, the big computing power is necessary for the calculation process to the sign [4]. In addition, the big disadvantage of Blockchain is the opportunity to split the chain. Since there is no information about the user in the public key of the cryptocurrency, Bitcoin enjoy a better degree of privacy than in other traditional digital transfer services [9].

C. The Attacks and Problems of the Blockchain technology

The Blockchain can be attacked by the different threats that can occurred, which are connected to the PoW and PoS protocols.

1) Attack of 51%. When two miners are calculating hash result of the block and getting same results at the same time, in that case Blockchain will split and users will have two different chains, and both are true.

2) Double-spending. Principe is the same as previous one, but here can be used the split of the chain to spend money again.

3) Sybil's attack. When one node accepts several essence, because network cannot authentically differ the physical machine.

4) DDo's attack. This attack is consistent of large amount of the similar requests. There is also a protection in DDo's attack.

5) Cracking of cryptographic. There is possibility to use quantum algorithm such as "Shora" which can break the RSA encryption. The scientists work on the cryptographically algorithms, which based on the hash function [4].

V. PRIVACY AND SECURITY OF BLOCKCHAIN TECHNOLOGY

A. Anonymity of transactions in blockchain

Mixing services can provide or increase anonymity for bitcoin users. Anonymity means that an entity inside of anonymity set is not identifiable. In a communication network, the anonymity set can be divided into the two sets, sender anonymity set and the recipient anonymity set. Unlink ability means that attacker cannot decide, whether a certain sender communicates with a certain recipient.

System might achieve high anonymity on a global level; the anonymity can be low, if attacker has context information available that allows him to reduce the anonymity set.

B. Transaction network on blockchain

A transaction represents a payment that is digitally signed with private key of the previous owner of the certain amount of bitcoins, who wants to reassign the possession of the coin to the public key specified in the transaction. Every user has its own address in the transaction network and the possession of bitcoin is stored in the blockchain as outputs of transaction, which refers to the address of recipient. Standard transactions usually has two output addresses, of which one belongs to the sender who receives the change happened in the transaction, the other belongs to payee. There are many possible blockchain application of transparency. A smart contract is a user-defined program running on top of blockchain [11]. It allows the execution of credible transactions between mutually distrusting agents, without allow third parties in transactions.

C. Mixing services

Mixing service is designed to prevent users' addresses from being linked. It represents random exchange of users' coins with other coins, where for the observer their ownership of coins are obfuscated. Mixcoin provides anonymous payment in bitcoin-like cryptocurrencies. Anonymity is similar to traditional communication mixes. It uses accountability mechanism to detect stealing, so it shows that users will use Mixcoin rationally.

VI. USAGE OF BLOCKCHAIN IN DATA ANALYTICS

The focus of Blockchain Data Analytics are few other alt-coins and Bitcoin. Analyzing the relationship between transaction and addresses and Bitcoin price, has become an important analytics research direction. There is a growing focus on building statistical models that can predict and attribute price movements to transaction and transactions graph properties.

VII. RELATED WORK

Blockchain Social Network are an emerging class of social media platforms that bring new governance structures and economic mechanisms along with them [12]. Steem is an open source social media platform that enables the creation, curation, and consumption of multimedia content [12]. Account creation is free to anyone. Steem is a public and permissionless blockchain database, where blocks (witnesses) are elected by the community of Steem users. The blockchain database can be accessed by an unbounded number of user interfaces.

Rumor Spreading Model represents model in which can characterize the rumor spreading dynamics for a social network with group of fixed participants. Using blockchain to this model will have group of initial social network participants who have signed a blockchain-enabled trust contact. Blockchain can reduce peer violence on social network throughout anonymity and secure transaction between parties in transaction. These related works can be used for forming a research on blockchain social network influence.

VIII. CONCLUSION

Blockchain represents new type of database that solved some of the problems in the centralized system, such as transaction without intermediary. It shows its potential for transforming traditional industry with its key characteristics: decentralization, persistency, anonymity and auditability. Currently development of blockchain technology is in financial domain and more application for different fields are appearing. Blockchain also finds its application in big data, as data management and data analytics. Blockchain has big influence on social network today, improving transparency and security. Blockchain based application are springing up so growth of this technology is getting so fast.

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Application of Loop Learning

V. Brtka*, E. Brtka*, V. Makitan*, D. Karuović*, A. Lunjić**
*University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Serbia
**Primary school „Maršal Tito“, Ulcinj, Montenegro
vbrtka@tfzr.ac.rs; norab@tfzr.ac.rs; vesna@tfzr.ac.rs; dijana@tfzr.uns.ac.rs

Abstract - This research deals with the idea of loop learning and its applications in education. The aim of this research is to investigate this kind if learning in order to improve learning capabilities of students in higher education environment. Main goal is set towards bringing awareness of learning styles and loop learning in order to increase creativity. Paper presents the idea of loop learning, as well as an illustrative example of loop learning application.

I. INTRODUCTION

It is widely recognized that educational system is in constant change, but this change is sometimes an aggravating circumstance because it forces changes in a system that is very inert by its nature. This brings many problems that directly affect the degree of organization of the educational system, efficiency and resource consumption. As significant changes of education system are hard to achieve, there are efforts toward small changes in education practice. With extensive use of sophisticated modern information and communication technologies, as well as their rapid development, a platform for modern education is established, called mobile learning. Such a platform does not involve a mandatory change of teaching methods, although this is desirable but hard to achieve. The change in approach is reflected in raising the awareness of students and teachers about the processes of learning and thinking, especially in the direction of creative thinking and learning that supports creativity and new ideas.

Creative thinking is the ability to generate new ideas and extend old ones, to suggest hypotheses, and to look for alternative innovative solutions. Thinking is observed in relation to learning as learning occurs everywhere and recursive includes fundamental process of thinking. Thus, learning and thinking process are inseparable.

This study will focus on learning styles in form of loop learning with the aim to explore its potential. The main goal is to bring awareness of studying styles to students and teachers. It is considered that knowledge about learning styles and familiarizing students with them is a small, unpretentious step that can be done without significant resource usage.

The paper is organized as follows: Second section gives some background about learning strategies, learning and thinking processes. Third section describes loop learning and gives possible applications and advantages of loop learning. Last section contains conclusions and possible directions of future work.

II. BACKGROUND WORK

Two main processes that are in focus are thinking process and learning process. Both are very important for us, while interconnections between them are multiple and often not clearly understandable. Thinking process, as well as learning process has been studied very thoroughly. There are more than few questions concerning learning and thinking interconnections: Do we think while we learn? Also: Do we learn while we think? There are important differences between "learning to think" and "thinking to learn", but this investigation deals rather with form of learning and how to think in order to learn. Further insight to these and similar problems can be found in [1, 2, 3, 4, 5].

Effective review of the model of thinking process and types is given in [6]. There are four stages of thinking: input, process, output and feedback, as depicted on Fig. 1. By linking these four stages, a thinking model is created.

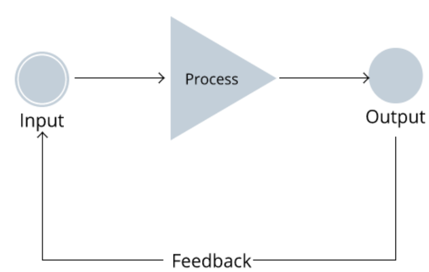

Figure 1. *Model of thinking process*

Thinking is initiated by information input, followed by processing stage. This is most important stage of the process. The process gives an output, which is evaluated and through feedback loop thinking process is engaged again. There are four main types of thinking process:

Critical thinking, creative thinking, problem solving and decision making.

In [7] the learning process is also tackled. According to this author, there are five learning styles depending on engaged sense or transmission medium:

- visual learning (eyes) - learning is done by watching movies or drawings or get involved in other activities that rely on eyes,
- auditory learning (ears) - learning is done by listening rather than reading or watching,
- sequential learning (order) - there is a need to put things in a particular order before learning them,
- global learning (images) - learning by seeing a whole picture and often don't need to work through individual parts, as sequential learners do,
- kinesthetic learning (doing) - learning by doing things.

In [8] the use of technology along with face to face teaching is investigated. Usage of smart gadgets is discussed. Some services and devices are considered such as: Moodle, Voice Thread, Screencast, Prezi, podcasts, blogs, social media, polling, smart boards and smart phones. Polling can be used as a means of reflection, student's feedback, and is implemented via smart phones. Authors also believe that the core objective of teaching is information or knowledge transfer to the minds of the students. In addition, the authors state: "The purpose of education is not just making a student literate but adds rationale thinking ...", so that interconnection between thinking, learning and technology becomes obvious.

In [9] cognitive constraints on learning are considered, these are: attention, working memory, and executive function. There are also insight to learning strategies and how to choose right one. Author notes that "The bad news is that we tend to stop studying and testing ourselves on things we believe we've already learned". This all indicates that the learning process within the loop can be of great benefit. The question is how to form a loop for the purpose of learning and how to use it.

III. LOOP LEARNING AND APPLICATIONS

According to [10] and others, adaptability becomes ever-increasingly important. This is due to the fact that we live in a highly complex world that does not operate in a linear fashion. As complexity, uncertainty and non-linear nature of socio/eco systems put limits on predictability, acknowledge of the dynamic nature is relevant. The acknowledgment of constant change is indeed necessary in order to cope with many tasks while managing organizations, but this is also true for domain of education. One way to cope with described problems is to form mental model which will help in decision making procedures. These problems were tackled in [11, 12] via so called loop learning. These loops include decision process, as well as decision making model, frequently based on decision-making rules. The form of the rules is usually: $\alpha \rightarrow \beta$, where α is the antecedent of the rule while β is the consequent. These rules need to be of a general type. The system that includes decision making, decision rules and mental model is iterative and based on a loop. So called single loop learning model is shown in Fig. 2.

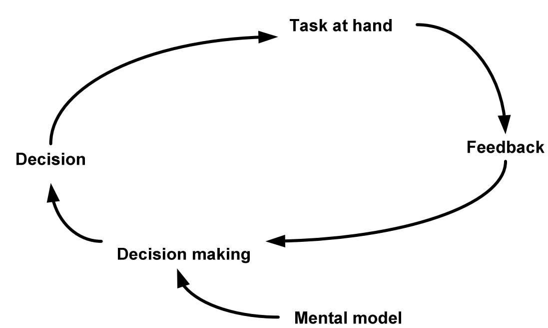

Figure 2. *Single loop learning*

The task at hand is a problem that has to be solved or conducted. This is usually real world problem meaning that complexity and dynamic nature are both present. Task is handed by decision making, which is usually conducted by inference engine based on rules, as previously described. There is information feedback after which whole process is iterated. The mental model is the most important element of the system because it determines the rules for the decision making, if mental model is changed, then decision making rules are changed, and consequently decision is changed. In order to enable change of mental model, double loop learning is introduced, see Fig. 3.

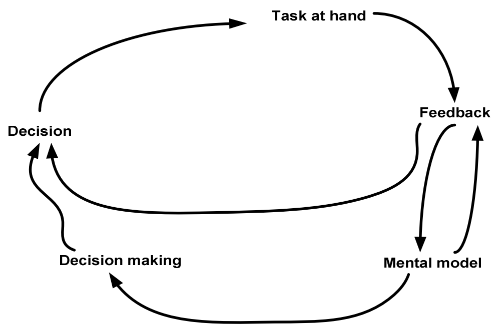

Figure 3. *Double loop learning*

In case of double loop learning, information feedback impact the mental model, thus changing its nature or structure. After that, new or enhanced decision making rules are formed and decision according to these new rules is produced. This produces shift in understanding, from static knowledge to more dynamic and changing. Introduction of double loop learning is a way to respond to changes in environment, thus enhancing adaptability of decision process. Single loop learning, as well as double loop learning are both used to manage organizational tasks and to bring innovation, but the usage in education is more prominent. Double loop learning is a way to introduce creativity because it enables modification beyond simple adapting to current situation.

A. Application example

In this sub-section an illustrative example of single and double loop learning application in education is presented. In this particular case, task at hand is a classification problem: Let X be a set of people characterized by height. Task at hand is to classify them to set of tall people Y and to the set of all other people Z, considering their height. A single simple rule is needed to classify every element $x \in X$ so it becomes clear if x belongs to Y or Z. The rule is defined according to (1), this is characteristic function of a set:

$$\varphi(x) = \begin{cases} 1, & height(x) > m \\ 0, & otherwise \end{cases}$$

(1)

Now, rule is defined as follows: If $\varphi(x) = 1$ Then $x \in Y$ Else $x \in Z$. In (1) constant m is threshold and it is necessary to apply the rule. Single loop learning application enables to carry out classification task, by defining m = 180*cm* it is possible to separate tall people. Decision is achieved by applying Modus Ponens (2).

$$\text{M.P.} \quad \frac{\alpha, \alpha \rightarrow \beta}{\beta} \qquad (2)$$

Feedback information indicates whether the classification process is well implemented or not, and in most cases this is correct. But, a problem arises when set X consists of basketball players; in that case m is incorrect because basketball players are taller than average people. Another example is when set X contains people of a specific demographic group; the average height of some African or Chinese people is below general height average, so that m=180*cm* is set to wrong value again. Single loop learning is not enough anymore, in other words: It is applicable but it generates decision which is not satisfying. It is now obvious that double loop learning will enable us to change mental model by changing the value of m and this is initiated by negative feedback.

This is the point when creativity and innovation have a chance to advance judgment. At this point main question is: "Is there a general way to solve this task?". In particular, generality is reduced to question: "Is constant m necessary?" with the meaning: whether the step function (1) is the only option. As the advantage of double loop learning compared to single loop learning is the modification of goals or decision-making rules in the light of experience, students become "open" for "experience injection", in this case in form of introduction of fuzziness and measure (3), as well as Generalized Modus Ponens (4). Instead of set Y defined by (1), measure μ of belonging to the certain set is introduced and set is defined by (3):

$$Y = \{(x, \mu_Y(x)) : x \in X\}, \qquad \mu_Y \rightarrow [0,1]$$

(3)

$$\text{G.M.P.} \quad \frac{\alpha', \alpha \rightarrow \beta}{\beta'}$$

(4)

In (4) antecedent α is not achieved, instead there is α' that is similar to α, so that consequent β' is similar to β to the extent that the α' is similar to α.

It is important to notice that this insight by students is not possible without understanding and applying single loop learning multiple times. They are now able to comprehend μ instead of m in a rule, as mentioned before, as well as the fact that all people are tall in certain measure.

B. Implications to programming skill set

There are certain implications of single and double loop learning to programming skills. Students are aware that all people are tall in certain measure and they are ready to code this problem. In Table 1 there are pseudo-codes after single loop learning (a), double loop learning (b) and "experience injection" (c).

TABLE I. LOOP LEARNING IN PSEUDO-CODES

(a) Single loop learning	(b) Double loop learning	(c) After "experience injection"

`m = 180;`
`Y = ∅;`
`Z = ∅;`
`for (int i=1;i<=card(X);i++){`
`  x=X[i];`
`  if (height(x) > m) add(x,Y);`
`  else add(x,Z);`
`}`
	`read(m);`
	`Y = ∅;`
	`Z = ∅;`
	`for (int i=1;i<=card(X);i++){`
	`  x=X[i];`
	`  if (height(x) > m) add(x,Y);`
	`  else add(x,Z);`
	`}`
		`Y = ∅;`
		`for (int i=1;i<=card(X);i++){`
		`  x=X[i];`
		`  add(x,Y,measure(x));`
		`}`

Table 1 shows students' approach to the programming implementation of classification problem after the application of single and double loop learning. It is evident how mental model changes from (a) to (b) and finally to (c), especially after double loop learning and "experience injection".

IV. CONCLUSION

Research suggests that there is much we can do to be better thinkers, especially when introduction of creativity and innovation is important. Single loop learning and double loop learning are appropriate ways to improve creativity, while loop learning serves as a "skeleton" for "experience injection", meaning that after loop learning students are open to accept new and different concepts.

Main goal of investigation presented in this paper is to evoke awareness of learning styles and loop learning. When loop learning is presented to students, they are more open to accept new ideas and concepts. This is true especially after they became aware of double loop learning concept and possibilities of changing the mental model. Loop learning enables:

- explicit strategy of learning and creative thinking,
- motivation to learn,
- thinking about learning.

Loop learning also enables reflection on learning experience, creation of new ideas and approaches, as well as to deepen understanding. This is an attempt to make students aware of their own thinking, and to show them strategies they can use. General awareness of double loop learning existence and its advantages in ever-changing world is particularly useful. When single loop learning fails multiple times in consequence, it is possible to exploit double loop learning advantages. This insight to learning seems to be of enormous importance for personal education.

Further investigation will include: additional investigation of loop learning, application of loop learning in different education scenarios and automation of loop learning through software applications.

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Analysis of the Presence of Violence on Social Networks in School Age Children in the Territory of Central Banat Using Blockchain Technology

D. Lacmanović, D. Glušac, D. Radosav, N. Ljubojev
Technical faculty Mihajlo Pupin, University of Novi Sad, Zrenjanin, Serbia

Abstract - This paper presents an interdisciplinary research including analysis of the presence of violence on social networks in school age children in territory of Central Banat. The use of the Social Networks provides many opportunities for the psychosocial development of pupils. However, the results of the survey show that children on the Internet, besides positive ones, also experience different negative experiences and digital violence. The authors of this paper are analyzing the digital violence relevant for the protection of school age children as Internet users. A survey among the pupils of one primary school in the Autonomous Province of Vojvodina, northern part of Serbia, was carried out. This work is the continuation of the research that has been published as Child Protection on the Internet and Parents' Perception (Ljubojev at all, 2017) and Blockchain technology.

I. Introduction - Theoretical Backgorund

Young people are frequently described as a digital generation, a generation defined in and through its experience of digital computer technology (Buckingham, 2013). During the past 10 years, the rapid development of social networking sites (SNSs) such as Facebook, Twitter, MySpace, and so on has caused several profound changes in the way people communicate and interact (Pantić, 2014). Research in Europes shows that social networks are very popular among children and adolescents in Europe. It seems to be their favorite Internet activity, as 77% of children aged 13 – 16 and 38% children aged 9 – 12 have their profiles on social networks. Research in the Republic of Serbia shows that younger children use the Internet for entertainment (playing games, listening to music, watching videos, and movies), while the older ones mostly use social networks (Stevanovic at all, 2014). The expansion of individual computer usage, the Internet and social networks are recognized by psychological research studies (Vidanović, Anđelković & Đorić, 2012) as a way of escaping loneliness, finding new friends and related interlocutors, etc. Using social media Web sites is among the most common activity of today's children and adolescents (O'Keeffe, & Clarke-Pearson, 2011). Individuals visit social media sites to engage in many different types of entertainment and social activity including playing games, socializing, passing time, communicating, and posting pictures (Allen & all, 2014). Young people are increasingly using social networking sites (SNSs) to engage with others (Wilson, Fornasier & White, 2010). National legislation should also regulate the protection of children on the Internet as vulnerable groups in the new security area.

II. Legal Framework

By enacting the Law on the Ratification of the UN Convention on the Rights of the Child ("Official Gazette of SFRY - International Agreements ", No. 5/90 and" Official Gazette of the FRY - International Treaties ", No. 4/96 i 2/97), Republic of Serbia committed itself to taking measures to prevent and ensure the protection of children from all forms of domestic violence, institutions and the broader social environment. The Convention on the Rights of the Child (CRC) (was adopted on 20 November 1989, by the Resolution 44/25 of the United Nations General Assembly) is the first international legal document which contains the catalog of all the children's rights. Article 1 of the CRC defines "child" as any person "below the age of eighteen years unless under the law applicable to the child, majority is attained earlier." Importantly, the CRC leaves open the option for States to adopt lower or higher ages of majority, thus giving States Parties some leeway in defining childhood.

The Republic of Serbia is a signatory to two European Council conventions: Convention on Cybercrime (adopted in Budapest in 2001) and Convention on Protection of Children against Sexual Exploitation and Sexual Abuse (Lanzarote

Convention) which regulates the prevention and fight against sexual exploitation and sexual abuse of children, protection of the rights of children who have become victims of sexual exploitation and sexual abuse, as well as the promotion of national and international cooperation in the fight against sexual exploitation and sexual abuse of children**.**

The Lanzarote Convention came into force in 2010 and Republic of Serbia, by its ratification at the same year, became a contracting state, which means it has overtaken very clear obligations in implementing the Convention and in overall child protection from all forms of sexual exploitation. The Convention on Cybercrime from 2001 represents the first international document where child pornography and computer systems are explicitly associated. Among other things, its importance is also in creating special state authorities specialized for fighting against cybercrime. After the ratification of the Convention on Cybercrime and the Additional Protocol, in Republic of Serbia, ("Official Gazette of RS", No.19/2009) there were renewed the Criminal Procedure Code ("Official Gazette of RS", No. 72/2011, 101/2011, 121/2012, 32/2013, 45/2013 i 55/2014) the Law on Organization and Jurisdiction of the Government Authorities in Suppression of Cybercrime ("Official Gazette of RS", No. 61/2005 i 104/2009) and the Criminal Code (CC) ("Official Gazette of RS", No. 85/2005, 88/2005 - 107/2005 - 72/2009, 111/2009, 121/2012, 104/2013, 108/2014).

The Special Prosecutor's Office for Combating High-Tech Crime (Special Prosecutor's Office) was established by the Law on Organization and Competence of State Authorities for Combating High-Tech Crime from 2005. In particular, the Prosecutor's Office is responsible for the prosecution of perpetrators of criminal offenses of high-tech crime and it is competent to act on the entire territory of the Republic of Serbia. Pursuant to the provisions of this law, the High Court in Belgrade for the territory of the Republic of Serbia is competent for dealing with high-tech crimes, while the second instance court is in charge of the Appellate Court in Belgrade. Also, by the provision of the Law on Organization and Jurisdiction of State Authorities for Combating High-Tech Crime, within the Ministry of the Interior, a High-Tech Crimes Service has been established, which acts on the orders of the Special Prosecutor.

In addition, it is important to include child protection on the Internet in the future Strategy for Development of Information Security of the Republic of Serbia, which would lead to the strengthening of the legal framework and the capacity of institutions that deal with children. There is no national law that regulates the safety of children on the Internet specifically, but the changes of the CC from 2003 defined that exploiting the computer network or communicating with other technical means for the commission of criminal offenses against sexual freedom against a minor person (Article 185 b) is defined as a criminal offense punishable by law. If this act were committed against a child, the prison sentence would be from one to eight years (Article 185). The most important change is that the CC, for the first time, considers as a criminal act owning and obtaining photos, audio-visual recordings or other items of pornographic content created by exploiting minors.

In domestic regulation and strategic framework, computer systems and information communication technology (ICT) are mentioned only as a medium, i.e. the way for sexual exploitation of children. Thus, the competent executive bodies approach this topic primarily from the criminological point of view, and are more focused on the treatment of this problem of punishing perpetrators of the criminal offense of sexual exploitation of children who have also used ICT and suppressing this phenomenon after it has already happened, rather than its prevention by informing children and parents and educating on proper use of ICT and appropriate preventive care. Cyber bullying, characteristic for more and more frequent peer violence through ICT among children, as well as grooming and sexting are not recognized in any way as individual types of violence against children through ICT (Glusac, 2017) These types of electronic violence are important in legal regulation for two reasons: that systematic information and education of children and their prevention can be done, but also that their direct and indirect victims could be provided with adequate assistance and protection. In this regard, in order to prevent and protect against violence against children through ICT, it is necessary to improve the existing legal framework and positive legal regulations of the Republic of Serbia implement obligations from the accepted international treaties that the Republic of Serbia has entered into, as well as to further align the legal system of the Republic of Serbia with EU acquis in this area (Ljubojev, 2017). In addition, it was concluded that further amendments to the regulations are necessary in order to fully align with the EU acquis in the area of combating cybercrime.

The shift was made by the adoption of the Decree on the Safety of Children in the use of ICT, on the basis of which the National Contact Center for Child Safety was established on the Internet. For the first time, in the Republic of Serbia, by this Decree some preventive measures for childrens' security and protection at using ICT are regulated. The Decree also regulates the activities in cases of endangering childrens' security on the Internet. The aim of this Decree is to increase: the level of consciousness and knowledge on advantages and risks regarding the use of the Internet and the ways of its safe usage; improve digital literacy of children, students, parents and teachers; and improve the mutual cooperation regarding these issues. The Decree is in accordance with the Law on the ratification of the United Nations Convention on the Rights of the Child, the General Protocol of the Government of Serbia for the Protection of Children against Ill-treatment and Neglect, and the EU Strategy for a Better Internet for Children in 2012.

III. PRESENTATION AND ANALYSIS OF RESEARCH

As it presented in mentioned research, Child Protection on the Internet and Parents' Perception, the vast majority of parents of school age children is confused i.e. uninformed about the ways of protecting children and the fact they need institutional help for it. Actually, the parents were asked what activities their child is doing online, how much time they spend on a computer, and whether they know what the child is doing specifically, and whether they consider if some of these activities are risky. We were interested in our parents' views on whether they felt they were sufficiently instructed in the ways of safe use of the Internet and whether they felt they needed institutionalized support to protect their child. Also, parents were asked if they knew the legal and institutional framework for protecting their children on the Internet.

The questions were closed-ended with the simplest form of YES/NO answers, as well as with one or more offered answers. There was also given a possibility to write additional answers which were not offered, but a parent found them true.

The most important part of the questionnaire that asked parents whether they were aware of any inconveniences that their children had experienced on the Internet. We offered types of experiences: getting to know unknown people live, viewing pictures of sexual content, viewing images of aggressive content, experiencing insulting and degrading, insulting or abusing the child, misusing personal data, unplanned cash expense. A huge percentage of parents (as much as 57%) said that they do not know if their child experienced an unpleasant experience on the Internet, and 20% did not experience any child's inconvenience. 23% of them shyly chose one of the options that their child had unpleasant experiences on the Internet, and only one parent linked this testimony with the next one, asking for a statement about the unpleasant consequences of violence on the Internet over their children, that is, the child was upset after an experience. Here we have obvious confusion and lack of knowledge of parents about the activities their child is experiencing. In the survey, the majority decided to use the help the school would rovide mostly in terms of educating parents, but also worry about massive answers from parents who consider that they do not need training because they do not want to interfere with the "child job", that everything is a game, a harmlessness, and that inconveniences happens "there to someone far away, not exactly to us". This attitude is worrying, and it even more points to the need for an institutionally organized and mandatory training of parents about the dangers on the Internet and the necessity of their involvement. What surprised, however, is the dominance of parents' responses that they do not "interfere" with the activities of their children on the Internet at the moment, or that they do not undertake concrete activities to protect their child (55%). Only 11% of them check that the child behaves on the Internet, and as many as 48% say that they do not know if they are able to help their child to protect himself from Internet dangers. The obtained results showed that most parents are not familiar with the legal and institutional framework for protecting their children on the Internet.

IV. BLOCKCHAIN TECHNOLOGY

Distributed databases have been around for a decade, and relational databases have existed for even longer. Blockchain is another form of database, and they share many elements with traditional database forms, yet Blockchain is intended to be shared, by individuals, organizations and devices.

Blockchain allows digital information to be distributed not copied thus forming a backbone for the new type of internet. Nowadays the community is finding new potentials for usage of this technology.

Concepts of a Blockchain technology and of a distributed database are quite similar. In a way, data in a blockchain technology can be looked as a spreadsheet that is duplicated many times across the network, and there lies a similarity with a distributed database concept. By storing data in form of a blockchain the data that are identical across the network the blockchain does not have a single point of failure and it cannot be fully controlled by a single entity since there is no "master copy" of a blockchain. Data in this network is not centralized, it is public and easily verifiable, hosted by a vast number of computers at the same time and thus accessible to anyone on the internet (The Linux Foundation, 2016).

What what's make a blockchain technology so unique?

Identity

Blockchain implements a built-in identity mechanism used to associate activity on the network with a specific participant. By itself, the key pair is not revealing the participant's actual identity, however supplemental information can be associated with aforementioned key pair, merging on-chain and off-chain identities (Swan, 2011)(Lacmanović at all, 2017).

Permission gradient

Using the identity system as a foundation, permissions can be assigned to participants on a network at the most granular level. Because these permissions are also stored on the blockchain, a participant in the network can be certain that the uploaded data is only accessible by the party to whom access was granted, despite this data being hosted in a decentralized manner (Swan, 2011)(Lacmanović at all, 2017).

V. CONCLUSION

Some of the research findings are especially useful. Firstly, this research has determined that social networks are very popular among children and adolescents in Central Banat, Serbia. Also, the obtained results showed that most parents are not familiar with the legal and institutional framework for protecting their children on the Internet. Therefore, technological and legal solutions should Be offered. In that way, technology offer Blockchain implements a built-in identity mechanism used to associate activity on the network with a specific participant. This is one aspect, and on the other hand there should be an institutional solution. It is important to include child protection on the Internet in the future Strategy for Development of Information Security of the Republic of Serbia, which would lead to the strengthening of the legal framework and the capacity of institutions that deal with children.

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