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DIGITAL COMPETENCE IN THE PROFESSIONAL PROFILE OF THE TECHNOLOGY EDUCATION TEACHER

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Abstract - The article focuses on digital competence viewed as a complex notion construct. The structural configuration of digital competence has been defined through theoretical analysis, conclusions and the requirements of the European Reference Framework. The functions and the relation between the main constituent of digital competence- knowledge, skills and attitudes have been analyzed. Through the integration of three basic dimensions- the technological, cognitive and ethical, the contents frame of the key competences for technology teachers has been outlined.

I. INTRODUCTION

Digital competence is defined as one of the eight key competences within the European Reference Frame for the levels of professional qualifications. The Framework document was approved by the European Parliament and the European Council in 2006 and since then has become main orientation point for the major changes happening on all educational levels. As it is well known, the changes aim at harmonizing the main parameters of the educational systems in all European Union countries; the objective being the creation of a unified European educational space. A major part in this process is played by the key competences for lifelong learning as a tool for providing the necessary quality of modern 21st century education.

In its essence the European Reference Framework for key competences is a manifestation of a new education policy- one not defined as in the past by opposing political ideologies but an education policy based on such social and economic arguments as globalization, growth, steady development, high qualification, career development and life-long learning. It is on this basis that the eight key competences are pointed out and defined, which is doubtlessly useful both semantically (clear semantic configuration) and terminologically (unified terminological approach). In this sense digital competence, which is the subject of this paper, and the rest of the key competences (communication in the mother tongue, communication in foreign languages, mathematical competence and basic competences in science and technology, learning to learn, social and civic competences, initiative and sense of entrepreneurship, cultural awareness and expression) are seen as a structural definition and contents of certain knowledge, skills and attitudes.

II. DIGITAL COMPETENCE AS A COMPLEX NOTION CONSTRUCT

According to the definition within the Reference Framework the essence of digital competence involves 'the confident and critical use of Information Society Technology (IST) for work, leisure and communication [1]. As the definition shows digital competence should be viewed as a complex notion construct, which is confirmed by the opinion of Lars Adreasen expressed in his article 'Digital competence and ICT in relation to education and lifelong learning' where he says: 'I see digital competence as what is needed for being able to act; to learn play and work in a society, which is more depending on digital computer-mediated networks. ICT is in different ways becoming an integrated part of the working life, the education, and the everyday life, and therefore practically everybody- a nurse, a child, an unskilled worker- must know how to handle ICT in different circumstances" [2].

We have to note, however, that other authors who have their attention on digital competence focus on purely technical characteristics and tools (mainly software applications) and by doing so make them extremely important in developing digital competence and at the same

time claim them a prerequisite for the modern individual to have high-quality lifestyle and successful career.

This trend is easily understood as technology developers have turned digitalization from a dreams-and-ideals-filled space into a modern tool for a more realistic perception of the processes and phenomena of our environment, a tool that makes communication more efficient and, not less importantly, helps individuals identify themselves professionally in a global society. In this sense the notion of digital competence is overloaded with semantic meanings dominated by the leading presence of information and communication technology (ICT) and its related applications which are characterized as having a multiplying effect. Thus, the following questions arise:

1. What is the 'volume' of the digital competence notion?
2. Which one of its structural components prevails- knowledge, skills or attitude?
3. How should the notion of digital competence be operated with in all the private cases of educational practice and how should it be approached?

In its nature and meaning each of the above questions outlines the field for theoretical, empirical research and more complex analyses – psychological, educational, technical and technological, sociological, methodical, etc. They are extremely important in achieving a unified understanding for the genesis and development of digital competence not only as a technical and technological construct within the educational environment but also as a psychological and pedagogical construct within the modern education of the students and the professional qualification of their teachers.

The personal observations I have made as a university professor and an author working in the field of technology education in secondary school grade and also training qualified technology education teachers have led me to the conclusion that generally the matter of the competence approach in education has been developing in a positive way. In Bulgaria the research of N. Tsankov and L. Genkova are among those which have led to precision in the understanding for the nature of the not clearly defined conceptual pair **competence – competency** [3]. New features in the nature and role of digital competence have been outlined by R. Marinov [4] whose efforts are concentrated in the field of **efficient communication**. In Serbia S. Popov and M. Danilovic have been working for long years to make technology education in secondary-school grade more modern by introducing ICT and by making digital competence a leading factor in the training of technology education teachers [5]. In practice experts have given high evaluation to the work of D.Glusac [6]. In Russia the work of S. N. Babina, E. F. Sharipova and A. S. Tihonov [7] in the field of 'technology and entrepreneurship' has also contributed to better understanding of digital competence.

III. STRUCTURAL CONFIGURATION OF DIGITAL COMPETENCE

In order to fully form and develop digital competence in the different stages of education, it is necessary to point out its main structural constituents and their subordination. There are different approaches in differentiating the constituents of each type of competence and their relations. For instance, Russian scholars accent on the activity-based and personal approaches when discussing the structure of the competences in the professional profile of the technology teacher. In Bulgaria, R. Marinov puts the stress on the relation between *communication and professional identity* [4] when discussing the structure of digital competence. When clarifying the role of the competence approach in education N. Tsankov differentiates between competence and competency, seeing it as a pair relation between concept and event (competence and performance). Distinguishing between competence and competency helps identifying competence as a personal subjective characteristic and competency as an objective, performance characteristic. This pair relation allows both terms to be used in scientifically correct and adequate manner and projected in technological variants for their formation and development through the different levels of school education [8].

The notional and terminological relation between competence and competency and its thorough identification is related to the more precise defining of the character of the relation they have with another pair of terms (notions)- that of *knowledge and skills*, which are said to have more scientifically determined features. As it can be seen from the European Reference

Framework for key competences the basic structural elements of each competence include knowledge, skills and attitudes. In the Frame document knowledge within the structure of digital competence is related to being familiar with the basic computer programmes, ways of saving and distributing data and understanding of the potential risks of using electronic means of communication through the internet. The skills include collecting and processing of information to be used in critical and systematical manner; also skills for assessing information and distinguishing between real and virtual but at the same time recognizing the relations between them; skills for using tools for creating and presenting information, internet based services; skills for searching for and understanding complicated data. The relations within the structure of digital competence should be based on the interest and motivation for critical, responsible and safe use of technology in information space.

IV. ASPECTS OF THE DIGITAL COMPETENCE OF TECHNOLOGY TEACHERS

Technology teachers in Bulgaria are trained in a Bachelor's programme with four year course of study at two Bulgarian universities- The South West University 'Neofit Rilski' in Blagoevgrad and the University Of Shumen (in the town of Shumen). One of the main documents determining the required professional qualification before the approval of the European Reference Framework did not have into account key competences. This can be explained to some extend by the past theory and practice in which different models and interpretation for the application of competence approach existed. We have to also say that the European Reference Framework for key competences is still considered by some applicable only for secondary school education. In the meantime higher education lacks a unified model for determining requirements for professional qualifications and therefore it is necessary to harmonize them through the requirements of the European Reference Framework. A successful example of such harmonizing fulfilled has been given by a project completed in the Department of Education in the South –West University. The completion of the project allows within the specialty 'Technology Education' the following competences to be determined as essential for the professional profile of the technology teacher:

- Educational
- Psychological
- Special Methodological
- Mathematical and Scientific
- Digital
- Foreign Language
- Technological.

The European Reference Framework has defined the necessary knowledge, skills and attitudes for each competence. The approach of A. Calvani, A. Cartelli, A. Fini, M. Ranieri, has been used to develop a model for assessment of digital competence based on its following aspects: cognitive, technological and ethical. According to the authors, the cognitive dimension determines the ability to read, choose, interpret and assess data and information, while bearing in mind their reliability and adequacy; the technological aspects includes the ability to flexibly find and research problems in the modern technological conditions; the ethical dimension is related to the possibility for realization of relations with other people through technological means in a constructive and responsible manner [9].

The integration of these three aspects allows us to determine the contents frame for the digital competence of technology teacher and set the following requirements to the professional profile of the technology teacher. The technology teacher:

- knows the natural world well and understands the role of ICT and possibilities it provides;
- knows the basic and specific characteristics of e-based education;
- knows the work principles and understands the exploitation of automatic devises and digital technology used in the process of education.
- has skills to use visualization through ICT in the technology education of students of different ages.
- has skills to create e-based education materials for the technology education of the students;
- has skills to use and adapt educational software for the technical and constructional activities;
- has skills to use school administrative software;
- has skills to manage and direct the process of creating the student's portfolio;

- has managing skills to organize the work of students in web communication projects;
- has positive attitudes towards the ethical principles and norms of healthy and safe use of ICT.

V. CONCLUSION

The efforts to identify digital competence within the qualification frame of the teacher have led to the conclusion that the term is very broad and has great integrative force, which determines its leading role in the system of internal links and relations of all key competences. The notion is characterized by an extremely dynamic contents determined by the fast changing processes in ITC. The social and ethic aspects of this type of competence are also to be paid attention to because they add to key competence another aspect – that of value, which will allow the analysis and construction of digital competences and all other key competences not only within the relation competence- competency but also within the relation value- competence. In that sense, one of the expected positive results when assessing the level of professional qualifications of technology teachers will be the development of a personal attitude in the teacher towards digital competence. It is expected that trained technology teachers will 'achieve understanding of digital competence and its educational potential as well as the possibilities it gives for integration in the process of education' [10].

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PROJECT "GRADUATION?! HOW? EASY!"

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Abstract - Project *"GRADUATION?! HOW? EASY!"* was formed following an agreement on cooperation between the heads of the School Board from Zrenjanin city, " HD Film", and a business incubator. It took a few minutes of constructive conversation that the potentials of these three subjects to unite and settle the idea of the project that has made very remarkable results, it turned out, not only in the Banat, which was originally intended, but much wider.

I. INTRODUCTION

A Holders of the Project

School Board in Zrenjanin city, (the developer), a separate department of the Ministry of Education and Science, and it includes the area of Banat and Senta, Ada, and Kanjiža (Three districts, 19 municipalities, 192 schools and 229 preschools. The main role of the school administration is monitoring and improving the quality of teaching in educational institutions, and that is why this project is fully in line with its mission.

HD Movie - Monolith style LLC, a partner in the project.

The main activity:

- Production of TV programs
- Production of feature films
- Production of documentary films
- Production of music videos
- Production of TV commercials
- TV network correspondent
- Direct Internet video transfers

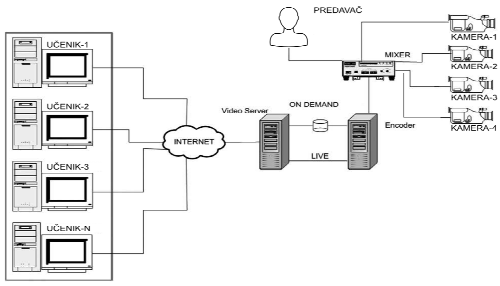
Business Incubator (BIZ), a partner in the project

Business Incubator Zrenjanin - BIZ was founded with the intent to support the entrepreneurial process of companies involved in information technologies and promote their innovations to the level of success of such companies increased. BIZ offers tenants a formal organizational environment with management, organized system of planning, monitoring and development of tenants, a system of performance measurement, provides training and education, including assistance in preparing a business plan, marketing, market research, assistance in developing technical and other documentation, obtaining adequate certificates and more.

The project was created based on the idea about using streaming video in distance learning (e-learning).

B WHAT IS VIDEO STREAMING?

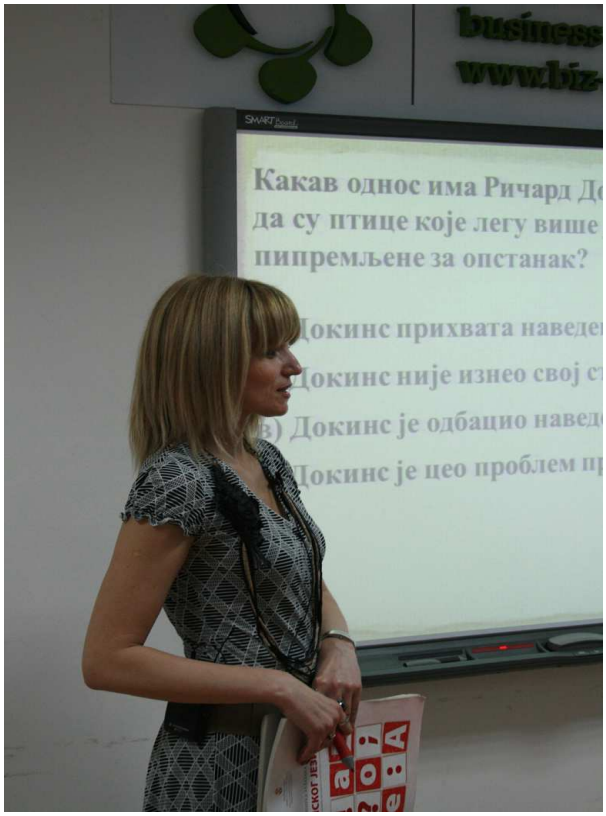
Streaming refers to a broadcast of a separately prepared (encoded) digital video recording or live programs over the Internet to the client or



user.

Materials prepared for the streaming will start automatically and remain on the user's computer. The recording is not necessary to download before broadcast because the download is done in real time during recording. The quality depends on the quality of streaming video production and the quality of the connection to the Internet users. The early 21st century begins and the great expansion of the Internet, and thus

a significant reduction of costs in connection with an Internet connection. This allows expansion of streaming. Streaming as such is still in development. Expectations are that the stream



takes a leading position in the broadcasting media, as broadcasting over the Internet has no spatial or temporal boundaries.

Signal from the streaming technology can be broadcasted in two ways: Live and On-Demand.

1. Live streaming is a live broadcast over the internet (another name webcast). Live video streaming is a direct transfer of video signals over the internet and works by BIZ sending encoded audio-video signal through the server to users via our web site to access the signal and watch (listen to) live broadcast.
2. On-Demand is to broadcast pre-prepared video.

The system On-Demand streaming works by the encoded audio-video archive on the server and is transmitted on demand by client/user.

What are the advantages of video streaming over conventional video clips on the Internet?

- Considering the load in real time, recording can last "indefinitely" and therefore the only way to live broadcast or live coverage of events to a wide number of users on the internet around the world.
- it is possible to broadcast long shots, such as lectures, seminars, media conferences, trade fairs, talks, films, and more.
- No pre-loaded images, which significantly contributes to the facilitation of the use by the client/ user.

II. BASIC FEATURES OF THE PROJECT "GRADUATION? HOW? EASY!"

The project included the teachers who were selected from elementary schools, to solve the tasks in front of video cameras, from the Collection of tasks for the final exam. Thus the recorded lectures were broadcast over the Internet on Tuesdays and Thursdays, scheduled to be completed 30 days before final exams, so students can once again repeat to identify material that it deems it necessary. It is important to note that all lectures are archived and students can download them from the web site of the school Administration, or Business Incubators, which was proved to be much more common case of direct monitoring of the original broadcast. All tasks in mathematics were addressed in the Serbian language, and questions designed to test the mother tongue were analyzed in Serbian, Hungarian, Romanian and Slovakian. The selected languages are mentioned, as such are the languages in education in School Administration of Zrenjanin city, and also because the tests on the final exam also taken in these languages. In preparation for teaching the languages of minority communities have helped us very much the Hungarian, Romanian and Slovak National Councils. It is important to note that solutions of the task of Collection are not just circled during broadcast, but the teachers always gave further explanations needed reminding students to the content of the material from which the questions are based. Teachers of mathematics often pointed students to various forms of solving some problems, because the goal of these lectures was not merely giving

answers and solutions to questions from the Collection, but also to develop creative thinking and observations, as far as possible, given the large number of tasks for a limited period of time. Indeed to conclude that this project encompassed a much larger part of the school curriculum than is imagined in the beginning, because students who have followed the lectures could be reminded of a substantial portion of material that are taught in schools.

Depending on the agreement with the teachers, all lectures are arranged by subject, and what is more important are those students are able, via the Internet or e-mail to ask questions, in the same way as their teachers responded to the students. At first discussed the possibility of broadcasting special programs, "specials" during which the teachers answered the most frequent questions, but it was dropped because of such lectures students have not shown a special need.

The room where the lecture took place has been prepared as a typical classroom because the idea was that its typical appearance and create the impression of uniqueness and singularity, as it is to this project, unique in Serbia, as it was. However, each lecture was accompanied immediately from students from nearby schools, because we felt it would be much easier for teachers to address the present students. It turned out that we were right, because our teachers confirmed that their presence has increased student motivation and facilitate the work. In addition, we tried to take advantage of yet another modern teaching tool, so called ‘‘Smart’’ whiteboard. Use of this whiteboard provides greater visibility and is particularly well-acted personnel changes in the moments when the teacher wrote on it, so that the content and method of the solution then was in the forefront.

WHY?

There are several reasons why we decided to launch this project:

1. desire to influence meaningful and useful use of computers among children and teachers,
2. modernizator and to overcome traditional forms of teaching via the Internet,
3. help eighth grade students for the best possible preparation for the final exam,
4. help teachers in schools to prepare students for the final exam (they were able to compare the way they work with the way teachers who handle tasks during the project),
5. significant savings of funds for parents who have children before implementation of this project paid for private lessons for preparing for the final exam,
6. To provide parents follow-up, prepare students for the final exam at home, with computers, with their children,
7. replacement of lost time and teaching hours during several months of strikes in schools during 2010/11 school year,
8. testing of IT equipment and the flow of information via the Internet in the Banat (for future projects)
9. analysis of seemingly simple forms of "distance learning" with the prospect of expanding facilities and programs,

10. inclusion of minority ethnic communities in a common project.

Each participant in the project gave the maximum in their area:

School Board has done the following:

- called the teachers of mathematics and mother tongue in elementary schools and prepare them for the project,
- made a plan of tasks from published Collections of tasks,
- informed the principals (139 principles of elementary schools)
- held meetings with representatives of local authorities, who immediately supported the project,
- informed the Ministry of Education and Science on the content of the Project
- forwarded links to all heads of school districts so that everyone in Serbia is able to monitor via the Internet transfer preparation for the final exam.

HD ''Film'':

- provide adequate equipment for recording hours of preparation, four cameras, video mixer, lighting, wireless sound equipment, digital video recorders, encoders and decoders, pictures,
- provide skilled technical team: cameramen, producers, video mixer, audio technicians, video editors, graphic artists,
- conducted a test recording and prepare for the broadcast transmission,
- prepared and designed graphics and web site announcement, provided the archive on the Web server in a video format 80 hours of lectures via the Internet,
- the information on using material during transfer, as well as the use of archived,
- transmitted via the Internet, two press conferences during which all potential users (students and teachers in schools) project was presented,
- provide additional funding for the project.

Business Incubator:

- provide adequate space for the direction and space for recording
- provided the conditions for the press conference
- provide a studio for recording lectures,
- provided the equipment necessary to administer the system used during streaming (server, internet area network bandwidth)
- organized a video-audio recording
- organized web site and storage space on the Internet,
- opened a separate video channel on the Internet for the project,
- provide IT logistics for conferences.

Timing of the project: from April 06th to June 19th 2011

Ministry of Education and Science has started the implementation of the strategy of the final exam, “Graduation", which in its final analysis involves solving tests with a completely unfamiliar tasks, in accordance with the introduced, the long-awaited standards. This strategy is being implemented gradually, so that the tests in mathematics and mother tongue, which were taken in 2011 contained 25% totally unknown tasks, 25% changed from the collections of tasks that were released earlier this year, and 50% of tasks that were identical to those from the Collection of tasks. So, our "Internet” lectures have greatly helped the students to adequately prepare for taking the test in the final examination in both subjects, in 2011.

III. EVALUATION

Each evaluation includes the criteria by which they are committed. We, the School Board, and especially the holders of this project is very important to you and how much it contributed to the increase in performance results of students in eighth grade final exam.

There are several aggravating circumstances that it was not possible to compare the level of

achievement this year's results with results from past years:

1. tests for the first time in the history of Serbian education, formed the basis of three levels, in line with the introduced mandatory educational standards for the completion of primary education, which means that there are a number of tasks from the basic level, significantly lighter than the real tasks of average difficulty in tests from past years,
2. last test was not done in accordance with the standards, and contained 25% of tasks from the Collection that had altered figures, and all other tasks are known, from the Collection.
3. This year the final exams were required for all students to complete them, since the release were receiving a certificate for an elementary school. So, this year had a higher attendance, but the larger the number of those who will be totally unprepared, appear on the test, because there was no low admission in order to pass. Simply, it is sufficient to eighth grade students to appear on the exam and obtained the condition for the completion of compulsory basic education.

These three reasons make it clear that student achievement from last year and this year were far to compare.

For these reasons, the evaluation can only be done through a questionnaire which we will not try to compare the achievements of students, but we will examine how the project helped students and teachers to better prepare for this year's Final Exam (the extent to which students are familiar with the project, if they have used its capabilities and to what extent they are satisfied or not with what was offered, and the like).

IV. RESUME

We shall ask students and teachers to send us suggestions on how and in what way we could help them via the internet to achieve better results in education, because we would like to continue with the implementation.

By participating in this project together we came to new ideas on how to use the benefits offered by properly applied information systems used in the best possible way. Here are some:

- Distance Learning
- treatment of some complicated areas, particularly in mathematics and other sciences;
- work with gifted children, preparation for competition;
- cross-border cooperation, preservation of the original mother tongue of minority representatives,
- savings for the School Board, ” meetings" via the internet, et cetera.

Finally, the fact that speaks for itself: with over 8000 different internet addresses were followed by direct broadcast, and more than 48.000 lectures were downloaded.

THE VISUALIZATION ENGINE CONTROLLED BY SCRIPT IN E-LEARNING ENVIRONMENT

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Abstract - Scripting languages expand into computer graphics. In this paper, one of these scripting languages – RUBY language is presented. A practical demonstration of rotation scripted in RUBY is also presented in this paper. For model representation and visualization, a special tool for distance control of graphics simulations called SuperEngine was used.

I. INTRODUCTION

Recently, scripting languages play an important role in computer graphics and in other areas of informatics. The scripting language is also a programming language but with some differences. Main difference is that the script is not a program. It is a code, which is probably execute by other program programmed in other language such as C++, C# etc.

Script is mostly executed using its source code, but sometimes it is pre-compiled. This compiled code is called byte-code. The interpreter compiles the script into byte-code. From historical view, first scripts were developed in mid 1960s. Since that, scripts are improving and expanding to many programs and to many forms of scripting languages.

One option is to implement visualization using various scripts that could be distributed into several network places. This way of visualization flow control allows remote control of visualization by sending commands via the network, e.g. students logged in into an e-Learning system could check their computer graphics task solutions from the distance of their homes [8,9].

In the optimal case, a server is running the visualization kernel on its powerful hardware, and it is responding to the queries (scripts) of clients with less powerful hardware [1,2]. The server side of the solution should have a significant parallel property, e.g. it could be a cluster or grid.

The most widespread script languages are for graphics. Scripting languages are many kinds for example RUBY [3], PYTHON [4], LUA [5]. This article focuses on RUBY scripting language.

II. RUBY

Ruby is script language which name is derived from ruby crystal. Ruby is programming language with focus on simplicity and productivity. It has an elegant syntax that is natural to read and easy to write. History of Ruby is dated to year 1993. In this year Yukihiro Matsumoto presented this simple scripting language. Interpreter of Ruby is written in C language. [3]

SuperEngine [6] was used as Ruby visualization program. SuperEngine is executing environment used especially for visualization scripts programmed in Ruby language. SuperEngine used objects exported from Google SketchUp [7].

Objects exported from SketchUp are exported in .obj file extension and must be converted into .bin file extensions by convertor, because SuperEngine doesn't support .obj file extension, only .bin file extension. SuperEngine than renders these objects, also here is used a script written in Ruby.

This script provides translation of object in scene, their rotation, and moving direct camera. In script are defined procedures, functions and here is also described scene.

SuperEngine consist of two parts, one is render window (Fig. 1). In render window is rendered scene, here are objects that are moving as in movie people are walking, cars are moving on the road. Here are two ways to moving objects

This work was supported by VEGA grant project No. 1/0646/09: "Tasks solution for large graphical data processing in the environment of parallel, distributed and network computer systems."

Figure 1. SuperEngine render window

on the scene. First simple is moving direct camera about objects and second hard way is use script to scripting objects and their moves.

Second part of engine consists of some libraries, batch files and control center.

III. ROTATION

Rotation is a movement of object in a circular motion. 2D object rotates around a center of rotation. 3D object rotates around a line called axis. Rotation matrixes for X, Y and Z-axes are (1), (2) and (3) respectively:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\alpha & -\sin\alpha & 0 \\ 0 & \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (1)$$

$$\begin{bmatrix} \cos\beta & 0 & \sin\beta & 0 \\ 0 & 1 & 0 & 0 \\ -\sin\beta & 0 & \cos\beta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (2)$$

$$\begin{bmatrix} \cos\gamma & -\sin\gamma & 0 & 0 \\ \sin\gamma & \cos\gamma & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (3)$$

Transformation matrix multiplied with scale matrix (4):

$$\begin{bmatrix} s_x & 0 & 0 & 0 \\ 0 & s_y & 0 & 0 \\ 0 & 0 & s_z & 0 \\ x & y & z & 1 \end{bmatrix}. \quad (4)$$

Rotation matrixes (1)-(3) and transformation matrix ((4), with s_x, s_y, s_z = 1) are multiplied

together and new resulting matrix is multiplied with point and this point than had new position. Matrixes multiplication is different to classical multiplication. In matrix multiplication is important order from left to right. For completing rotate transformation is needed scaling. Scaling is process to enlarge or reduce object. Resulting matrix is therefore multiplied with scale matrix ((4), with x, y, z = 0). s_x, s_y, s_z are factors of scaling.

This rotation is sometimes called transformation of world. These matrixes can be also transformed to some formulas. In simple formula it is transformation: world = move * rotation * scale.

IV. ROTATION IN RUBY

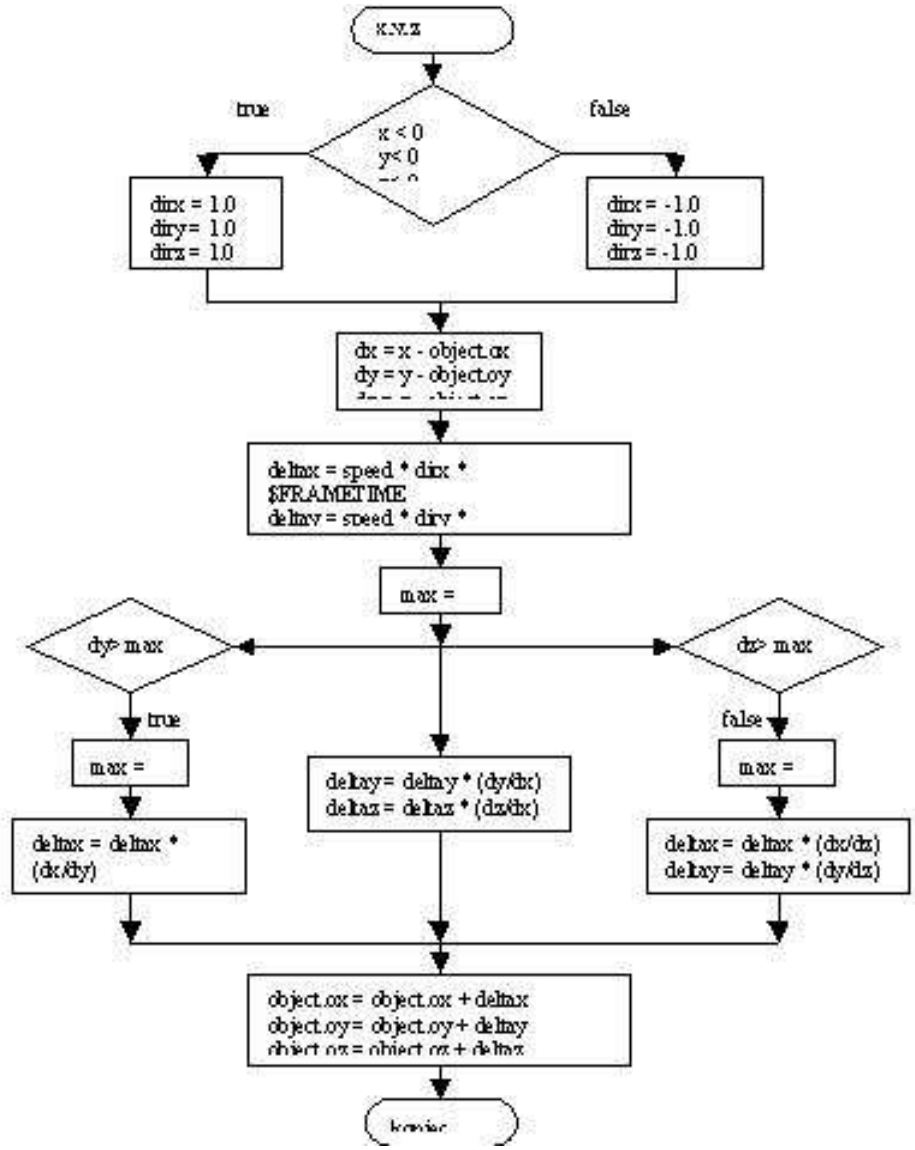
In this part of paper is presented example of rotation in Ruby scripting language. Rotation is defined as 3D vector or angle for specific axis. For objects rotation around their own axes are used

suffixes ox, oy and oz.

Example of the source code:

```
//definition of procedure for rotation (speed is speed of rotation)
def Rotation(object,x,y,z,speed=1)
//save coordinates into variables
     dx = x - object.ox;
     dy = y - object.oy;
     dz = z - object.oz;
//coordinates multiplication with time factor and speed of movement
     deltax = speed * dirx * $FRAMETIME;
     deltay = speed * diry * $FRAMETIME;
     deltaz = speed * dirz * $FRAMETIME;
```

Figure 2. Rotation flowchart



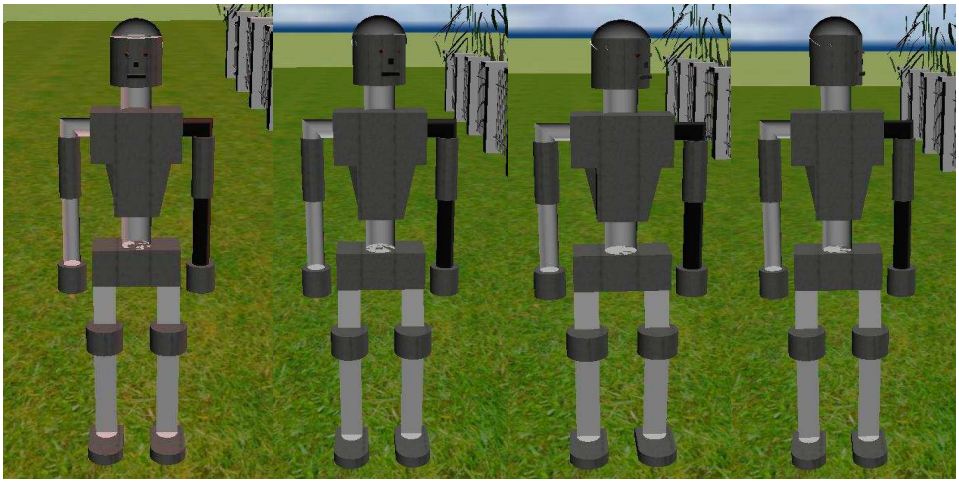


Figure 3. Animation frames from scripted head rotation

```
// setting new coordinates for object
      object.ox = object.ox + deltax;

      object.oy = object.oy + deltay;
      object.oz = object.oz + deltaz;
```

For better understanding of this procedure is shown on the flowchart on Fig. 2.

Fig. 3 shows simple head rotation scripted with RUBY and visualized with SuperEngine.

V. CONCLUSION

Scripting languages allows a wide range of programming capabilities. Originally were meant only for process automation, but their usage overcomes all expectations. Scripting languages are also used in applications programming with using graphics processors. In these applications has been noticed a substantial increase in computation speed compared to standard processors.

In this paper was presented RUBY scripting language with which was created procedure for object rotation in 3D. As visualization software was used SuperEngine and created script was tested on simple 3D model of robot. Presented procedure shows, that RUBY is suitable scripting language for computer graphics.

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EVALUATION OF EDUCATIONAL SOFWARE FOR THE GIFTED STUDENTS

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Abstract – In order to determine level of applicability of educational mathematics software in gifted education, the study authors compiled a list of expected characteristics of gifted students with a focus on student creative thinking. The list was used to conduct summative evaluation of selected educational software packages. The evaluation results are presented both in numeric and narrative form. The results indicate that the skill-based transmission software commonly does not provide environment that allows development of creativity. In opposite, the open-ended constructivist software is a more favorable environment, in which students have opportunity to perform more complex tasks that encourage curiosity, imagination and allow risk-taking. Also, when using the open-ended constructivist educational mathematics software, students can be genuine in their work, can express fluency and flexibility. This study results can serve as a guideline for a selection of software that could be used in gifted education.

I. INTRODUCTION

While there are several different definitions and approaches to define giftedness, the single definition cannot encompass all types of abilities and characteristics that occur among gifted children. Koren defines giftedness as a set of qualities that enable individuals to consistently achieve above average results in one or more activities that are involved in [9].

Renzulli's definition of giftedness is somewhat more extensive, he defines giftedness as a set of characteristics that enable individuals to consistently achieve above average results in the activities they are involved in and that these results significant creative contribution to the filed in which they occurred [7]. It is important to emphasize that this definition has limitations since it is not including students that are creative but at certain point do not achieve above average results.

It is crucial what definition of giftedness is accepted as an educational policy guideline that determines overall approach of the school system towards gifted and talented education. The Croatian National Educational Standard (CNES) states that a desirable educational approach is geared towards high educational standards and achievements [5]. Also, CNES states that it is important to strengthen methods of identification of gifted children and create opportunities for developing their aptitude in one or more areas. Teachers and other professional staff in primary schools should put more effort in identification of gifted and selection of educational approach which is best suited to the gifted child. CNES puts an emphasis on the two educational approaches. First approach focuses on the design and implementation of a special or enriched educational program where gifted students stays in the same class with their peers but work on highly individualized tasks. The second approach is based on acceleration where gifted students have opportunity to move faster through the program and to finish primary school earlier than their peers [5].

Besides clear definition of giftedness, it is crucial to define identification methods and methods of work with gifted, talented and creative children. When discussion identification methods, George emphasizes that measurement scales are more reliable than general checklists [7]. The measurement scales include subscales focusing on creativity, leaderships, motivation and learning characteristics, which are in a correlation with gifted students' characteristics.

This study focuses on Guilford's and George's determinants of creativity [7]. Although creativity determinants are recognizable and easily described, literature does not provide a precise definition of creativity and clear identification instruments. George writes that Guilford argues that creativity includes innate ability and sensitivity to the problems and ability to redefine and elaborate [7]. Furthermore,

Guilford lists four main abilities related to creativity: fluency, flexibility, originality, and elaboration. In addition George lists additional four abilities that could be used as determinants for creative thinking: curiosity, complexity, risk taking, and imagination [7].

II. TEACHING METHODS FOR WORK WITH GIFTED STUDENTS

Cvetković-Lay and Sekulić Majurec list five main methods that have proven effective in working with gifted students: work on the project, work in small groups, individual work, extracurricular activities, and additional resources and materials [6].

- The project includes project planning during which students receive or select a specific task. The work on the project is independent while teacher should create favorable conditions for the work on the project. Furthermore, students during their work on the project use variety of skills in a greater breadth and depth.
- Work in small groups is of great importance for gifted students. In this type of activities it is possible to cooperate and socialize with other students.
- Individual work is extremely important for the gifted student development. The emphasis may be on the use of technology when there is a possibility for a provision of an individualized approach. Well designed software are created with the goal to expand knowledge and make learning easier, more interesting and better adjusted to the students' needs. Individual work should be based on the student interest, working pace and methods.
- During extracurricular activities there is a lot of flexibility and the teacher should devote time to individual activities.
- Additional sources and materials are essential in working with gifted students, since they provide opportunity for the engagement of their specific abilities (e.g., abstract and creative thinking, problem solving, accuracy, pace of work). Resources and materials that may be used are: books, complex logical and didactic games, and multimedia programs.

III. EDUCATIONAL TECHNOLOGY FOR WORK WITH GIFTED STUDENTS

Individualized teaching which commonly includes use of technology is very important in work with gifted students. Richey writes that focus of educational technology is on study of the theory and practice of learning which facilitates creation and use and management of technological processes [14]. Educational technology includes, but is not limited to use of software, hardware, Internet applications and various educational activities. According to The Association for Educational Communications and Technology, educational technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning [16].

Along with clear definition of educational technology, when dealing with the gifted education, it is crucial to review methods and benefits of technology use. Cvetković-Lay and Sekulić Majurec list a number of advantages of computer-aided learning in gifted education. It is possible to group these advantages into three groups: step-by-step learning, opportunities for repetition and practice, and interesting content presentation [6].

- In the step-by-step learning the eligibility for reaching the next learning level is determined by the acquired knowledge and skills. Gifted students should learn on their own pace, while the pace of learning in traditional classroom is dependent on the whole class.
- The opportunities for repetition and practice of the learning content are given through the assessment of the acquired knowledge and skills. Educational software programs include numerous possibilities for student practice, monitoring of their work and feedback.
- Educational software programs may provide interesting presentation of the learning content. In addition, computer environment allows implementation of creative projects (e.g. computer programming) that are of a great importance for the gifted education.

A. Educational software

Niederhauser i Stoddart conducted a study in order to determine ways in which teachers use different types of educational software [12]. As

a part of this study the authors offered a categorization of educational software and described two large categories of software: *the skill-based transmission software* and *the open-ended constructivist software*. The skill-based transmission software helps students learn basic facts and skills. It provides opportunities for repetition and practice, feedback and follows the student progress. The examples of the skill-based transmission software packages are *drill and practice* and *keyboarding software*. Furthermore, Niederhauser and Stoddart list three types of the open-ended constructivist software: *the interactive/educational games*, *the exploratory software*, and *the productivity/presentation tools* [12].

- The interactive/educational games are focusing on problem solving in a structured framework. There are often several ways to solve a problem and the way of finding the solution influences a final result.
- The exploratory software supports students in discovering and managing discovery. Participants decide how to use the software and assess what they have learned.
- The productivity/presentation tools encourage students to research, organize and present information. Educational value of these tools is dependent on the way of program use. While using this type of software students may use numerous external data sources (e.g. Internet, other software).

B. Software evaluation

Riedling emphasizes that educational software evaluation lists should reflect educational theory and should be research based, with the aim to obtain useful data [15].

There is a large number of educational software evaluation lists, while different Internet sites provide examples of educational software evaluation. For example, the Super Kids' Reviews provide evaluations of educational software that are written by parents, teachers and students, while each of them reviews different elements. The advantage of these evaluations is that they are conducted in a real environment and that they reflect variety of users views [18].

Software evaluation checklists include different sets of questions, such as: the precision of guidelines, navigation and help issues, error correction, options for student progress monitoring.

TABLE I. SOFTWARE CATEGORIZATION

#	**Software types**		
	Category	***Subcategory***	***Software***
1	Skill-based transmission	Drill and practice	Feed Fribbit Addition
2			Feed Fribbit Subtraction
3			Number Twins
4	Open-ended constructivist software	Interactive/ educational games	Thinking Blocks
5		Exploratory software	Planet Turtle
6			Fantastic Contraption
7		Productivity/presentation tools	The Geometer's Sketchpad

IV. RESEARCH METHODS

Squires and McDougall recognize different types of educational software assessment, such as software selection, reviewing and evaluation [17]. The authors emphasize that summative evaluation is commonly dealing with the quality and variety of experiences that the software can support.

In order to determine possibilities for educational software use in gifted education, the authors conducted a summative evaluation. Evaluation was based on the list of the expected characteristics of gifted students with a focus on student creative thinking. The main idea behind this evaluation was that educational software should provide an environment that supports development of creativity.

The list compiled by the authors includes Guilford's and George's determinants of creativity [7]. Furthermore, the list includes a short description of each ability:

- Fluency (F1) – the ability to find various solutions and options.
- Flexibility (F2) – the ability to think in number of different categories and from various points of view.
- Originality (O) – the ability to reach new, unusual, extraordinary and unique conclusions.
- Elaboration (E) – the ability to make additions and develop ideas.
- Curiosity (C1) – the ability to think about ideas.

- Complexity (C2) – the ability to generate alternative ideas.
- Risk taking (RT) – the ability to give and receive criticism.
- Imagination (I) – the ability to generate ideas that go beyond facts.

This study authors selected educational software (Table 1) and sorted it according to Niederhauser and Stoddart software categorization [12]. The selected educational software is available on the Internet and its dealing with the primary school mathematics (grades 1-4). Educational software which is focusing on mathematics is selected due to its features that are suitable for work with gifted students.

Lajoie emphasizes that technology use in teaching mathematics facilitates the development of mathematical ideas and deeper understanding of mathematical postulates [10].

V. SOFTWARE EVALUATION RESULTS

Evaluation results are presented both in numeric and narrative form. The Table 2 includes numerical data on presence (1) or absence (0) of the listed determinants of creative thinking skills in selected software. The columns are marked with abbreviations representing one of the eight creativity determinants, while the rows are marked with numbers that represent matching software previously listed in Table 1. The narrative section consists of description of software and way in which the particular software is aligned with a certain creative thinking skill determinant.

TABLE II. EVALUATION RESULTS

#	Creativity determinant							
	F1	***F2***	***O***	***E***	***C1***	***C2***	***RT***	***I***
1	0	0	0	0	1	0	1	0
2	0	0	0	0	1	0	1	0
3	1	1	0	0	1	0	1	1
4	1	1	1	0	1	0	0	1
5	1	0	1	0	1	0	1	1
6	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1

Software packages *Feed Fribbit Addition* [2] and *Feed Fribbit Subtraction* [3] in terms of *fluency* do not allow use of different problem solving techniques and there is no possibility for students to propose their own ideas. When it comes to *flexibility*, these two software packages do not offer different types of problem solving and students cannot elaborate reasons for a selection of a certain problem solving method. In terms of *originality*, the software packages do not allow proposing new ideas. Also students cannot show unique and unusual ways of problem solving. In regards to the *elaboration*, students have no opportunity to propose ideas that could clarify the basic idea, and cannot contribute with a variety of details that lead to the idea development. These software packages do encourage *curiosity* to some extent. The correct answers lead students to new tasks and new levels. When it comes to *complexity*, the software packages do not give possibility for expressing the alternative ideas. The *risk-taking* is related to students' willingness to play a guessing game. These software packages do not encourage students' *imagination*.

Number Twins [4] software evaluation determined that this software allows different ways of problem solving and to some extent encourages *fluency*. However, students have no opportunity to propose their own ideas. This software allows use of different problem solving techniques, so that it promotes *flexibility*. In this software, there is no possibility for students to propose new ideas. Hence, students cannot express their *original* ways of thinking. Possible ways of problem solving that could be used are listed at the start of the program. The students have no opportunity to propose ideas, so that this software does not encourage *elaboration*. The software content can stimulate *curiosity*, because correct answers lead students to new tasks and levels. The software does not promote *complex tasks*, and does not provide students with opportunity to express alternative ideas. *Risk-taking* is linked to the guessing of answers to the posted questions. Nevertheless, this software allows students to select the problem solving techniques and encourages students' *imagination*.

Thinking Blocks [11] software encourages *fluency* due to options that allow different ways of problem solving. These options can be selected according to student needs and abilities. The software is easily adapted to the individual user needs, but the advancement is linked to the speed of problem solving. The tasks can be tackled in different ways and this contributes to the software *flexibility*. The tasks encourage students *original* problem solving, nevertheless the students cannot *elaborate* on their ideas. The

content partially stimulates *curiosity* of students, since correct answers lead to the new and more complex tasks. The software does not allow implementation of *complex* ideas and it is not possible to link problem solving technique to the task type. If students *take a risk* and play a guessing game this could prevent them from proceeding to the higher level tasks. The software stimulates *imagination* through the variety of learning games.

Planet Turtle [1] software leaves the possibility for use of a variety of problem solving techniques. Students can select these techniques according to their needs and abilities. The software content can be adjusted to individual needs and encourages *fluency*. Although the tasks are clearly structured, the student selects the problem solving technique, pace of work and accuracy. The software does not promote *flexibility* because the limited number of problem slowing techniques is offered and students cannot elaborate on reasons for a selection of the problem solving technique. Planet Turtle software can be used by more than one student at the same time, and this option encourages *originality*. The students decide on the pace of work. Nevertheless, there is no possibility for students to *elaborate* their ideas. The software content does encourage *curiosity*, since correct answers lead to the new tasks and levels. Also, there is a possibility for students to further explore virtual world. The software does not allow implementation of *complex ideas.* The *risk-taking* is linked to guessing. It is important that this software encourages role-play which is linked to development of *imagination.* Student takes a role of turtle and learns through play.

Fantastic Contraption [13] software allows problem solving according to individual abilities. The student determines the speed of problem solving. Hence, it is possible to conclude that this type of software encourages *fluency*. This software encourages *flexibility* because students choose tasks to solve and ways of problem solving; also it is important that the tasks can be solved in different ways. Since it provides a unique and individualized problem solutions, this software encourages *original* ways of thinking. Although students are working individually on their tasks the software allows students to *elaborate* their ideas. The software contents and setup encourages student's *curiosity.* At higher levels, this software allows implementation of *complex* and alternative ideas. Furthermore, when working on their tasks students can play a guessing game and *take a risk*. The software encourages *imagination*, since students decides in what way and what time they will work on certain tasks.

The Geometer's Sketchpad [8] promotes *fluency* through different ways of problem solving activities and the options for work on mathematical calculations, charts and diagrams. This software includes tasks that are previously set, nevertheless the software encourages *flexibility* due to the fact that students decide on problem solving technique and work on their own pace. This software allows *original* problem solutions; the student has opportunity to work individually and to *elaborate* ideas. The software content stimulates *curiosity.* It includes numerous options and possibilities for problem solving. The user can draw complex geometric features. This is open constructivist software and students have a large freedom in implementation of their ideas. This option encourages *risk-taking.* Visually rich environment provides students with opportunity to implement various ideas and develop their *imagination.*

VI. CONLUSION

Studies on use of technology in gifted education are rare. The software evaluated in this study is available on the Internet, and the study results could be used to facilitate work with gifted students in schools. The selected educational software is dealing with primary school mathematics, since earlier research studies indicate usefulness of technology use in learning mathematics. Also, educational mathematics software commonly has features that are useful in work with gifted students.

The selected software is evaluated according to the list of creative thinking determinants. The list includes both Guilford's and George's determinants. The Guilford theory includes four determinants that are related to the development of creativity: fluency, flexibility, originality and elaboration. While George lists four additional determinants: curiosity, complexity, risk-taking and imagination.

The evaluation results indicate that the skill-based transmission software commonly does not provide environment that allows development of creativity. In opposite, the open-ended constructivist software is more favorable environment, in which students have opportunity to perform more complex tasks that encourage curiosity and imagination and allow risk-taking. Also, student can be genuine in his work, can express fluency and flexibility.

Finally, it is possible to conclude that the basic determinants of the ability of creative thinking, made on the basis of Guilford theory and George's list of additional creative thinking determinants can serve as guideline for a selection of software that could be used in gifted education.

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IDENTITY MANAGEMENT OF HIGH EDUCATION SUPPORTED BY SMART CARD

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Abstract - The Identity Management is a system used to support managing of personal information of users. The Identity Management System is very convenient for the support mobility of students, teachers and scientific workers in European High Education Area by beforehand established standards for attributes of identity. The smart card is a tool for providing security of identity data.

I. INTRODUCTION

The **World Summit on the Information Society** - WSIS [3] was a pair of United Nations sponsored conferences about information, communication and, in broad terms, the information society, that took place in 2003, and established definition of Information society. An Information society is a society in which the creation, distribution, diffusion, uses, integration and manipulation of information is a significant economic, political, and cultural activity. In other words it is a Knowledge society, society that creates, shares, and uses knowledge for the prosperity and wellbeing of its people. The Knowledge Society generally refers to a society where knowledge is the primary production resource instead of capital and labour. The conditions for generating knowledge and processing information have been substantially changed by technological revolution focused on information processing, knowledge generation, and Information and Communication Technologies.

This Society offers large possibilities such as new tools in education and training, easy access to public services, inclusion of disabled persons and bridging regions.

In developed Information Society, creation, distribution and manipulation of information becomes significant economical and cultural activity. Today, having proper information means advantage in economical race. The speed and efficiency of information exchange gives sensibility to act on any change on market condition, prompt act to improve position.

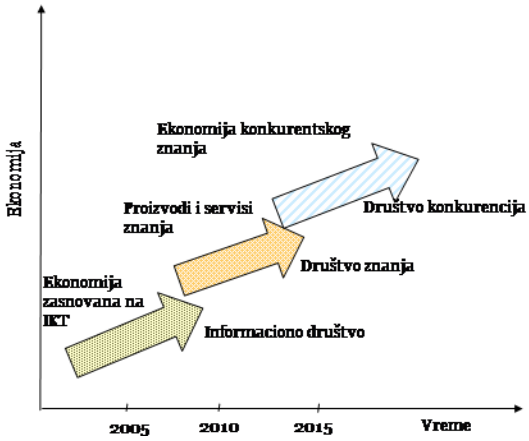

Figure 1. Development of economy and society

II. IDENTITY MANAGEMENT

Each organisation, which business is supported by IT through network of computers, could be presented as business building consisting of many offices and employees. In that situation the System Administrator gives or does not give privilege to access to the network resources. The management of this kind of data is simplified - Identity Management - IdM.

The Identity Management controls all users concerning the way of access to resources. If system requires only user name and password to access private network, that represents minimal form of IdM. For Identity Management System, we need more than simple log on data.

The Identity Management System IdMS provides management of adjusted access to IT environment for each user, determined by user's business function and required security. The IdMS improves business process and common usage of information. High level of security is provided by adequate managing of this system.

In spite of risk of unauthorised access to system, many organisations did not implement tool of IdM. Why? Because it is complicated. It is necessary to establish all authorisations according to legal regulations in order to provide privacy, and develop central DB of IdM, manage with authentication of each user and stimulate data management policy.

The consolidation of control access is very important for successful implementation of IdM strategy. On the level of software application there is some control. Because of lack of quality testing, control of access to each application has weak points. The centralised access to IdM provides automation and speeding up of the process. Beside the technology, it is necessary to define management of accounts policy. The consistent monitoring of access to system resources provides secure system. Simply, we can say that IdM is set of technologies to support managing of identity.

It is important to emphasise that each identity has a life cycle consisting of:

- *Account provisioning* - refers to a company's ability to provide its employees, business partners and customers with access to IT systems, applications and Web portals,
- *Account maintenance* – provides updated identity and
- *Account de-provisioning* – deactivation of users account.

The Identity Management System modules:

The first module is establishing of identity by link on a person's name or object and reestablishing of identity, e.g. by link on a new or added name or subject's or object's number.

The second module is identity description which is done by an arbitrary assignment of one or more attributes which are used for a certain subject or object as an identity, or re-description of the identity (e.g. changing one or more attributes of subject or object identity).

The third module represents activity flow, in which it is necessary to record and/or insure access to the identity activity protocol and optionally analyze the sample of identity behavior.

The fourth module deals with the destruction of identity if the user leaves organization, or identity management system.

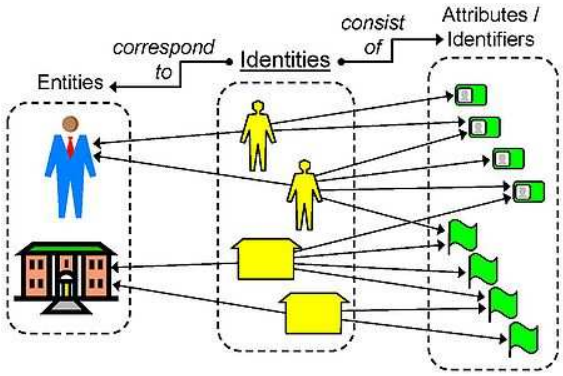

Figure 2. Identity concept (Author: Audun Josang)

The introduction of biometrical data into identity management system raises the level of identity data security.

How to improve quality of Identity management?

From the beginning of civilization, the identification of a human body was crucial in the creation of human society [1]. Hence, the identification of a person is an integral part of infrastructure which supports financial business, care for human health, distance learning, communication, judiciary, border services and many other areas.

The successful process of education depends in the first place on fragile and subtle interactions which are made mostly by communicable bonds between the subjects [7].

Biometrics which refers to the automatic person identification, based on its distinctive anatomic and behavior characteristics, can become an essential component of the effective person identification. Biometric components of an effective solution in person identification cannot be mutually used by several persons, cannot be shared or lost. Essentially, they represent physical identity of the person. Biometrics represents automatic methods of the person identification based on physical characteristics or behavior. It represents a simple relationship human – machine, insuring three basic functionalities: positive identification, wide range identification and authentication.

As society becomes more electronically connected and represents a large global community, it is necessary to enable a reliable identification of a distant person by method of automatic identification. Representatives of such kind of surrogate identification are passwords, which are mostly used as an electronic access control, and cards mostly used in bank and administration applications. Cards and passwords can be used by other persons besides those to whom they are assigned, by which a unique person identification is not insured.

Generally speaking, biometrics is exploration of measarable biological characteristics. Regarding computer security, biometrics refers to techniques of authentity check, which rely on measarable physical characteristics, which, subsequently, can be automatically checked. Any reliable system of person identification must include bimetrical components.Biometrics has an important role in applications for sample identification. There are number of useful biometric solutions already applied in practice.

Throughout the history, the problem of identification was elusive and inapprehensible in terms of efforts necessary for the achievement of satisfactory solutions. Besides, even until now, a man could identify a person with enormous accuracy, thus biometrics was considered unnecessary. Biometrics is considered as an essential technology in defining identification security system, because it insures the highest level of secrecy in identity verification.

Precondition for biometrical identification is to create data base with samples, which will serve as a comparative tool, and finally for identification.

One of the safest and most known forms of electronic identification is **smart card**. By adding biometrical data on smart card, the security of identification is increased.

Smart card is a card of standard dimensions with an integrated chip, integral circuits which can process information. Integrated chip can contain significantly more data than any other means of data upload, such as bar code, magnetic tape, optical tape, etc. This card is recognized as one of the safest and most known forms of electronic identification, and by adding biometrical data on smart card, the security of identification is increased.

Smard card is designed in a way to protect data which contains; most often requires PIN code (Personal Identification Number) in order to verify the identity of a card's user before authorizing access to card's information.

Card's computer chip requires smart card's reader, in order for a communication with a computer platform to be successful. A unique technology for chip protection is used. Biometrics increases the level of smart card's protection and represents very reliable solution from the aspect of privacy.

III. ELECTRONIC IDENTITY MANAGEMENT

In IT technology, Identity Management is regarded as management of information which represents items in real life, for example users, organizations, equipment, services, etc. Identity engineering requires explicit information. IT industry has developed several identity management interpretations. The evolution of Identity Management is closely related to the development of Internet Technologies. In the environment of static web sites and portals of the 90s, corporations have explored the delivery of information from the web sites. Because information changes out of different reasons, the possibility of conducting self service or updating help-desk shapes information more effectively, which is nowadays known as the Identity Management.

IV. IDENTITY MANAGEMENT IN HE

he precondition for the establishment of European dimension in higher education is overcoming present obstacles. The process of Higher Education reform in Europe, the Bologna process (the establishment of EHEA by 2010, the main goal of Bologna process), promotes students' and teachers' mobility. The establishment of this kind of mobility within the EHEA requires certain preconditions, namely defining standards which have to be accepted by all higher educational institutions. Larger mobility of higher education within the EU enables better exchange and flow of information and ideas, and the adoption of good practice of the higher educational systems within the EU members.

Mobility is the means of enlargement of effectiveness and the quality of educational system among the European Union members and other European countries, because it enables better exchange and flow of knowledge and ideas, as well as the adoption of good practice.

The precondition for quality establishment of mobility is the establishment of Identity

Management in higher educational institutions. I will state two examples.

For example, at London Kingston University, with 23000 students and 2000 employess, the project *University without walls* is being At Belfast Queen′s University, new expanded smart card system is being implemented, which offers additional improved services. New card will be given to all employees and students. Some of the card's characteristics are:

Acces to data and books in library

Access to all university areas

- Access to parking lots
- Shopping in university stores
- Paying in restaurants, etc.

V. CONCLUSION

Identity Management has an important role in educational processes, especially within higher education. Its usage, with respect to generally accepted standards for identity attributes, accompanied by biometrical data, can effectively support basic principles of Bologna process, such as the mobility of students, teachers, scientists and other participants of the higher education within the EHEA.

EUA (European University Association) should define necessary standards which refer to developed, which will enable virtual access to all university resources from any location. This kind of project requires the support of a complex Identity Management, which, for many, represents the main security challenge.

education data, scientific research, bimetrical data, in order for higher educational institutions to adjust their ID systems, implement those attributes into the smart card identities, thus insuring mutual compatibility.

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Evaluation of Students' Work on Data Modeling -Teaching Improvement Implications

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Abstract - Data modeling is one of the most important activities in the process of information systems development. This paper presents educational context for evaluation of students' data models and implications to quality of teaching process.

I. INTRODUCTION

Data model correctness is one of aspects of data quality (DQ), as a general concept. The consequences of poor data quality systems functionality could be experienced in everyday life and has far-reaching significance for efficiency and effectiveness of organizations and businesses. One of examples of data quality impact is the Data Warehousing Institute 2002 report which shows that data quality problems cost U.S. businesses more than 600 billion dollars a year [1]. Quality data modelling depends on education, experience, project limitations and operational needs of real systems. In aim to improve teaching in the field of data modelling, our goal is to create an educational framework which would help in evaluation of teaching conceptual data modelling.

First we propose model for evaluation of elements of teaching process in data modelling and analyse available evaluation data. Analysis of problems and suggested solutions are described. Contribution include educational framework for teaching and examining students' work in data modelling. We also consider automation of the evaluation process of students' data models.

II. EVALUATION MODEL

We propose a model for evaluation of all important aspects of teaching process (Fig.1), presented at Table I.

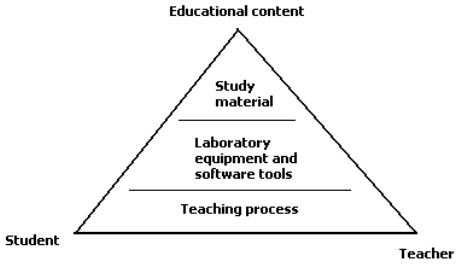

Figure 1. Factors of educational process

TABLE I. EVALUATION MODEL

Factor category	Perspective	Evaluation technique /tool
Student	Previous knowledge	Marks from previous subjects
	Interests	Questionaire about IT related interests Attendance and working effort estimation during lectures and practices
	Soft skills (intellectual)	IQ tests Personality tests
	Achievements	**Statistics on students' grades and exam errors**
	Workload	Questionaire with students' regarding workload Comparison of requirements of other subjects
Teacher	Behaviour, Availability	Qustionaire on students's evaluation of teacher and teaching
	Lecturing quality	
Educational content	Accurate according to technology progress	Research in modern technologies in this field: published papers from teacher Percentage of included scientific and technology content in curriculum
	Appropriate to study level	Questionaire with students about workload
Study material	Available	Library inspection results
	Complete	Comparing to curriculum and exam requirements - theoretical explanations, examples and exercises
	Clear and concise	Students' questionaire regarding study material

Laboratory equipment and software tools	Properly working	Laboratory administration register
	Modern according to advances in technology	Laboratory improvement plans and achievements report
	Appropriate quantity regarding to number of students	Number of students attending and number of computers in laboratory - comparation
Teaching process	Explanations, exercise, exam time and quality	Questionaire with students regarding teaching process

III. EMPIRICAL SURVEY

A. *Process of data modelling teaching*

Data models are specific theoretically based specifications that are used for creation of real databases of information systems [2]. Data model is a formal abstraction through which the real world is mapped in the database [3]. Data model enables representation of a real world system through a set of data entities and their connections. They can be represented in various ways: diagram (schema), data dictionary and formal representation [4].

At University of Novi Sad, Technical faculty "Mihajlo Pupin" in Zrenjanin, teaching conceptual data modelling is part of two main subjects: Databases and Information systems. Within the first subject, basic elements of data models and databases are presented, while at second subject data modelling is part of information system development and semantics of business problem domain is given in the form of text describing business process, business process models (PAM, BPM) and data dictionary from business process models. Conceptual data model (ER model) is designed by using CASE tool. Other models (relational, object-oriented model) are automatically generated afterwards, by using CASE tool functional features. Finally, database is created by using CASE tool according to previously generated relational model.

B. *Evaluation scope - sample characteristics*

Empirical survey that is conducted in this particular field is based on exam results (marks and errors) in subject Information systems at Bachelor degree levels, at University of Novi Sad, Technical faculty "Mihajlo Pupin" Zrenjanin.

TABLE II. NUMBER OF STUDENTS EXAMS ON DATA MODELLING

Year	Stud. No.	PI	DI	M	F
2004/05	61	15	46	29	32
2005/06	87	24	63	54	33
2006/07	83	20	63	57	26
2007/08	61	11	50	50	11
2008/09	52	14	38	38	14
2009/10	51	11	40	43	8

Stud. No - Number of students at exams, PI - professor of informatics course, DI - engineering informatics course, M- male students number , F- female students number

C. *Grading of students's work on data modelling*

Exams on data modelling within subject Information systems are organized as partial testing of knowledge and skills regarding creating data models for certain business domain. These exams present partial testing (for educational content regarding data modelling) within subject Information systems. This partial test on data modelling are organized in two time period / term (first term and additional term - for those that didn't attend first term or wish to improve marks).

Table II shows number of students that get certain marks on data modelling exam (first term) and number of students that didn't attend at exam.

TABLE III. NUMBER OF STUDENTS MARKS ON DATA MODELLING AT FIRST TERM

Year	n/a	5	6	7	8	9	10	Number of marks	Average mark
2004/05	5	11	8	14	11	6	6	56	7.20
2005/06	6	6	13	30	14	16	2	81	7.33
2006/07	25	0	4	10	26	6	12	58	8.21
2007/08	10	0	2	9	16	11	13	51	8.47
2008/09	20	3	1	0	2	13	13	32	8.88
2009/10	19	7	4	11	5	4	1	32	6.94

n/a - Number of students not attending first term exam

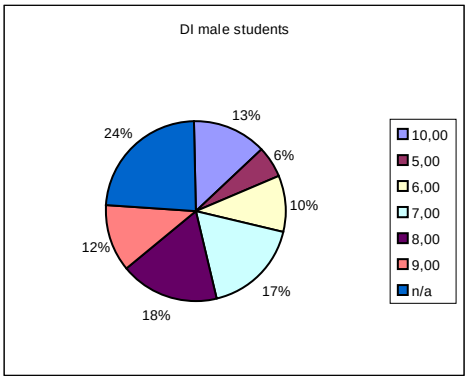

Figure 2. Grading of DI course male students

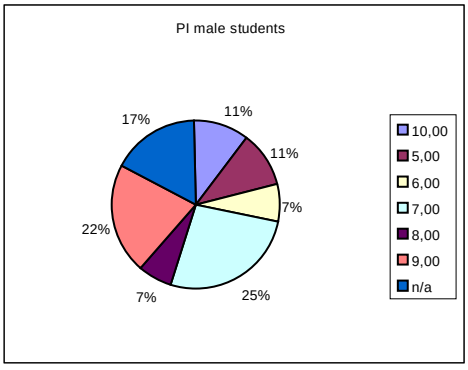

Figure 3. Grading of PI course male students

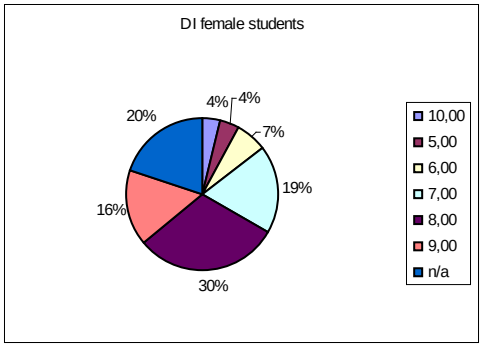

Figure 4. Grading of DI female students

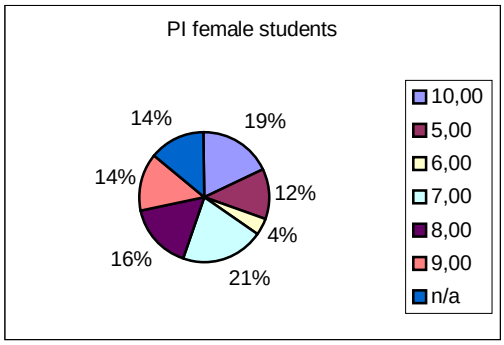

Figure 5. Grading of PI female students

D. Types of data modelling errors

Student errors could be classified as:

- Syntax and semantic related errors,
- Regarding elements of data model – entities, relationships and attributes.

Figure 1. shows statistics of students' errors categorized as syntax and semantic related errors.

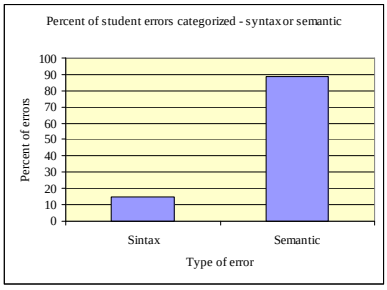

Figure 6. Students data modeling errors categorized as syntax and semantics

Errors are categorized by elements of ER data model. “Fig. 2” shows that most errors are made regarding attributes and entities and less regarding relationships.

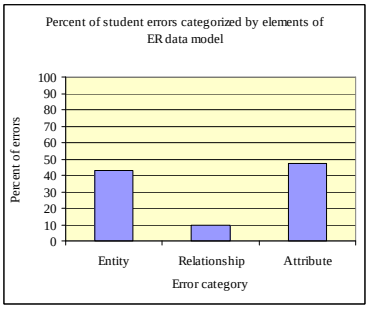

Figure 7. Students data modeling errors categorized by ER data model elements

List of some of typical errors are given below.

Syntax category (type) of student errors in data model:

- Identifier attribute is missing.
- Attribute without the domain/data type.
- Redundancy of attributes - repeating the same attribute at many entities, with the same meaning and different or equal name.
- Name of relationship is missing.
- Inadequate identifier attributes.

Semantic category (type) of student errors in data model:

- Using derived attributes.
- Incomplete set of attributes in an entity.
- No entity derived of a relation that has important attributes.
- Difference between general and specific, entities derived from attributes domain.
- Composite and complex attributes.
- Multi-valued entities.
- Not enough important relationships, needed to show different roles of entities related to other entities.
- Attribute named in plural.
- Entities of complex structure (made of other entities, entities named as documents).
- Name of an attribute is not clear, not easy to understand.
- Attribute attached to wrong entity (inadequate relation between entity and attribute).
- Putting attributes of similar names to one entity, where they don’t belong together.
- Inadequate name of entity.
- Important relationship is missing.
- Inadequate relationship.

- Inadequate name of attribute, name of attribute as a data value.

E. Analysis of statistic results

Average mark of students work in data modelling was rising. Significant improvement was in 2006/07 year, from 7.33 to 8.21. The reason for this mark improvement could be in change of exam tests. Starting from that year, students got separated bussiness modelling exam and data modelling exam, while in previous years they were parts of one exam, so student had very hard exam that included both tasks.

Rising average marks lasted until 2009/10 year, when it significantly fall from 8.88 to 6.94. The reason for this fall could be in change of number of lessons and practical laboratory work hours per week. Previously they had 4 hours for lessons and 4 for practical laboratory work per week, and starting from 2009/10 they had 2 hours for lessons and 2 for practical laboratory work.

Number of students that didn't attend first term is significant (starting from 2006/07) comparing to number of students that got their marks at first term. The reason for this could be in rising demands for details at exams (after exam tests for busness modelling and data modelling was separated) and having difficulties to acomplish the required level. Starting from 2006/07 we included extra pre-exam preparation lessons time, in aim to help students get ready for exam by letting them practice at similar tests texts that could be included in real exam and self-evaluate their knowledge before actual exam takes place.

Analysis of data modelling errors show that many generations of students make similar types of errors. There are more semantic then syntax errors because:

- There are syntax verification of created models in CASE tools, while semantics verification is not available in CASE tools.
- It is much easier for students to know syntax rules then to apply appropriate semantics mapping of business domain to data model elements.

Syntax types of errors could have roots of problems:

- Inappropriate time for exam solving,
- Students' syntax knowledge,
- Too much syntax rules to memorize and apply.

Semantic types of errors could have roots in problems:

- Lack of framework for procedure and rules regarding semantic mapping direct students to applying heuristics approach, which they consider reliable and trustworthy.
- Inadequate students' soft skills and mental abilities (which leads to inadequate process of abstraction, generalization, specialization, analysis and synthesis).
- Inappropriate scope of problem domain at exams - too wide scope brings insufficient time for data modelling during exam period, but too narrow scope brings too simple models to create, not according to the needs of real organizations information systems.
- Inappropriate level of details required at exams - too much details is not easy to accomplish within specified time period for solving exam, but too low grading criteria lead to inadequate knowledge and skills needed for real world business environment.
- Data modelling is based on certain business domain which should be known to student, but real organizations need is to have student be ready for any problem domain.
- Insufficient convergence in solving problems.Students are used to apply convergent thinking, instead of divergent thinking and evaluation of many solutions. Design is creative work where there could be many solutions for data models and each can be evaluated from different aspects, but only one is to be submitted to teaching staff.

Additionally, there are few problems from teaching staff perspective:

- Workload in exam evaluation and grading: Large number of student works to examine according to many rules they have to follow; applying equal criteria and rules for all students.
- Examining models from semantic perspective, i.e. level of business problem alignment depends of business domain knowledge / experiences.
- Exam evaluation and grading of different solutions to a single business domain. It is hard to evaluate design, since there could be many solutions.

IV. PROPOSED SOLUTIONS

A. Strategic goals / actions for teaching improvement

According to previously presented evaluation model, we propose set of goals and activities in aim to improve some elements of teaching process and students' outcomes.

TABLE IV. GOALS / ACTIVITIES FOR IMPROVEMENT

Factor category	Perspective	Goal/activity
Student	Previous knowledge	Adjustment of educational content from different subjects
	Interests	Including real world problems Including modern technologies Additional marks for working effort during lectures
	Soft skills (intellectual)	Including psychology as subject at course and psychology exercises
	Workload	Adjustment of workload with other subjects at a course Adjustment of exam scope
Teacher	Behaviour, Availability	Organizing teaching courses to improve teaching abilities
	Lecturing quality	Creating a manual with teaching instructions
Educational content	Accurate according to technology progress	Publish papers about recent technology issues Renew educational content frequently according to technology change
Study material	Available	Publish study material at website/distant learning system
	Complete	Set exam requirements according to available study material with explanations, examples and exercises
Laboratory equipment and software tools	Properly working	Frequent laboratory administation
	According to advances in technology	Frequent laboratory technology improvement
	Appropriate quantity	Laboratory equipped according to number of students

B. Teaching process improvement

Teaching process could be improved in several aspects:

- Educational content regarding the needs of software industry include all Bloom's taxonomy levels,
- Data modelling design patterns should be considered to be acceptable in educational process and exams, since they are used in professional environment. This could improve quality of students' data models.
- Creating a procedure and rules for semantic aspect of data models and business domain mapping,
- Creating software tool that could help students learn data modelling procedure, syntax rules and business domain mapping,
- Enhancing teaching time and teacher availability - giving additional exercises during free time, availability via e-mail, distant learning system with frequently asked questions and teaching material available.

C. Enhanced Bloom's taxonomy for data modelling

We propose enhanced Bloom's taxonomy [5] as an educational framework that describe the structure of educational goals to be achieved. It also presents a basis for selection of educatuional content and teaching methods as well as students' knowledge and skills evaluation.

TABLE V. ENHANCED BLOOM'S TAXONOMY LEVELS FOR STUDENTS' DATA MODELLING

Technical skills	Using CASE tools
Knowledge	Recall and reproduces data modelling concepts and syntax rules
Soft skills (intellectual)	abstraction, generalization, specialization, analysis, synthesis, evaluation, imagination
Comprehension	Understand reasons of errors Understand reasons of rules Distinguish correct and incorrect models
Application	Recognize data modelling errors Creates data dictionary, ontology and data model according to business domain (semantic aspect of data model) Creates data model without syntax errors Creates data model according to heuristics Adjust data model design patterns to specific business domain
Analysis	Creates submodels of complex model
Synthesis	Creates complex model of submodels
Evaluation	Check usability of conceptual data model by creating physical data model and SQL queries Uses ontology to compare data models Compares data models and choose best according to certain criteria (optimal model)

D. Grading process improvement

Grading process of students' work could be improved by:

- Educational content separated to multiple partial exams, so level of details and knowledge is rising and workload during exam is lower.
- Separating syntax and semantic aspect in grading of exam evaluation. Introducing grading levels: 1) syntax verified model, 2) semantic (business domain mapped) model, 3) optimal solution.
- Creating a tool for automated data model evaluation from both syntax and semantic aspect, to enable teaching staff improve objectivity, uniformity and efficiency of exam evaluation and grading.

E. Software tool for automated data model evaluation

Many of proposed activities for improvements' are already included in teaching process of data modelling. One of them includes creating specific software tools:

- Educational software for data modelling learning,
- Software tool for data models evaluation [6] and grading.

Software tool for data model evaluation from syntax aspect transforms XML form of data model made in CASE tool to predicate logic form suitable for automated reasoning tool Prolog and integrates it with

reasoning rules regarding syntax aspect of data modelling. The following use case diagram (Fig.8) presents software functions of software tool for analyzing conceptual data model.

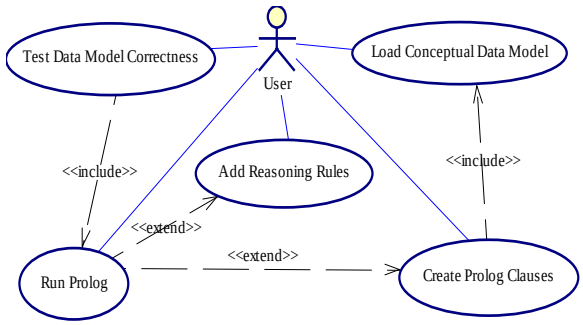

Figure 8. Use case diagram of a software tool for conceptual data model analyzing [6]

Software is developed in MS Visual Studio.Net environment. User interface with sample data model analysis is presented at Figure 9.

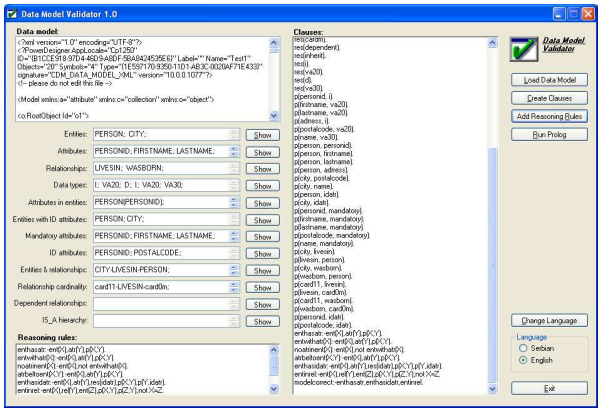

Figure 9. Software tool for conceptual data analysis [6]

V. CONCLUSION

In this paper we propose a framework for evaluation of educational process. We present results of statistics regarding students' grades and typical syntax and semantic errors in conceptual data modeling. We propose set of strategic goals and activities regarding improvement the educational process. Regarding teaching process, we propose enhanced Bloom's taxonomy as basis for educational content, teaching methods and evaluation of students' knowledge and skills.

Future work would include development of integral information system for education process evaluation, educational software for students' learning in the field of data modeling as well as enhancing functionality of developed software for data model evaluation. Existing software solution [5] includes syntax aspect and is developed for conceptual data model evaluation. It should be improved to enable evaluation of other data model types, as well as enabling semantic mapping to business domain to be evaluated by using ontology models.

Adaptivity of computer based testing of student's knowledge, like in [7], could be enabled by using rules that relate to specific types of data models. These rules could be formalized in predicate logic form [8] and transformed in the form suitable for processing by automated reasoning systems.

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TEACHING INTRODUCTORY PROGRAMMING IN C# AND SMALL BASIC

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Abstract – The choice of the first programming language is considered to have a substantial influence on future development of computer skills. At the Faculty of Sciences, University of Novi Sad, two introductory programming courses are offered to the students of the first year of Mathematics. Here we consider the second course, called Programming 2, which is optional. This course is taught in C# and aimed towards developing general programming skills and building a foundation for scientific applications of programming. Since C# is a complex language, a question arises whether it is suitable for beginners. Small Basic is a much simpler programming language, targeted towards beginners. We conducted an experiment during the school year 2010/2011, in which we taught two distinct groups of students, one in C# and another in Small Basic. The group which was taught in Small Basic later transitioned to C#. We present the results of our experiment in this paper.

I. INTRODUCTION

At the Faculty of Sciences, University of Novi Sad, two introductory programming courses are taught to the students of the first year of Mathematics. The first course, named Programming 1, focuses on Matlab and is compulsory. The second course, named Programming 2, is optional. As Programming 1 is taught in a specific programming environment, we do not consider it introduction to general programming. Therefore the aim of Programming 2 is to familiarize the students with general and scientific applications of programming. We were placed before a tough choice of a first general purpose programming language for the course. We shall refer to such a language simply as the *first programming language*.

Programming courses are generally considered difficult and have low completion rates [1]. Students of mathematics have many difficulties to overcome while learning how to program. According to [2] there are five domains of problems in introductory programming courses:

- general orientation — the capabilities and applications of programs;
- the notional machine — an abstract model of the computer used for executing programs;
- notation — the syntax and semantics of a particular programming language;
- structures — the structuring of basic operations into schemas and plans;
- pragmatics— the skills of planning, developing, testing, debugging, documenting, etc.

These domains are not mutually exclusive, and they overlap. Students which encounter programming for the first time find it difficult to grasp these concepts and start learning efficiently. Another problem is that the students usually try to learn everything at the same time [3], without recognizing important concepts and gaining a solid foundation first. As a result, some students either fail or drop out of the course. Some of the students that pass the final exam get low grades. They try to avoid programming later in their careers, as they do not feel confident enough in their programming skills.

The choice of the first programming language is widely discussed as it has a profound influence on the formation of students' programming skills and techniques. Choosing a programming language also often means choosing a related programming paradigm [4]. Moreover, the limitations, either real or perceived, of the chosen programming language and programming environment, shape the programming habits and keep limiting the programmer for a long time unless he/she invests additional effort in overcoming them. The choice of a "good" or

"powerful" programming language does not necessarily mean that the language is well suited for beginners [5].

II. SMALL BASIC AND C#

In our opinion, the language that gets chosen as a first programming language for students of Mathematics should have the following properties:

1. Simple, so that the students can start programming immediately;
2. Powerful enough, so it can be used in solving real-world problems;
3. Support for procedural and object-oriented programming styles;
4. Consistent syntax and semantic rules;
5. Provide documentation and hints to programmers as they work;
6. Provide enough information in error messages during compilation and debugging;
7. Widely known, accessible, well supported with abundant literature and examples;

Obviously the first and second properties are opposed to each other. The third property stems from our experience that the procedural programming style, and some aspects of object-oriented programming are also easily adopted. Most algorithms for scientific computation are also presented in this programming style. Consistent language rules and a *friendly programming environment* which actively assists the programmer (properties 4, 5 and 6) are a natural choice.

An important property we placed before our programming language is that the knowledge the students gain in our course doesn't stay an "isolated island". In other words, our aim is to provide concrete and useful knowledge to the students, which they will use during their studies and professionally. It should be noted that, from today's perspective, this usually implies an industry-standard, object-oriented language. Finally, it is extremely important that the development environment is free of charge, i.e. that the students do not have to pay for it.

We also believe that there is no need to teach the students all the specifics of any programming language, for two main reasons:

- Any modern features by today's standards may not be modern or even important five to ten years from now, which is when our students will be using their programming skills at work;
- The number of keywords, data types, built-in classes and additional libraries and frameworks is vast. Trying to present it all to the students can be counterproductive.

Therefore we limited the scope of the course to only those topics which are, in our opinion, most useful to the students.

Object-oriented languages are often cited in discussions about first programming languages. Their virtues and shortcomings are well known and discussed. C++ and Java are widely used, and Java is often taught as a first programming language, as it has a number of virtues [6]. On the other hand, teaching Java may be more difficult than we would like [7]. Some teachers have a different opinion and advocate the use of Pascal [8]. This point of view can be extended to all languages deriving from Pascal, such as Delphi and Modula.

It is also important to mention that Programming 2 may be the only course on general programming for students of Mathematics, depending on their choice of subjects in later years of study. Therefore we felt that it would be beneficial to the students if we teach them an industry standard language.

Having all this in mind, we decided to use C# as the programming language and Visual C# Express Edition [15] as the development environment. For students using Linux, we recommend MonoDevelop [16]. This is in line with the requirement that the software we use be free of charge.

We are aware that the same difficulties, which are encountered by students learning Java, will also appear here. Therefore, we tried to find out whether it would be beneficial for the learning process to start with a simpler programming language, such as Small Basic, and later transition to C#. We split the students into two groups, and taught one of them in the aforementioned way. The other group was taught in C# only.

Small Basic was developed as a programming language "that puts the fun back into programming" [17]. It is very simple with only

15 keywords and a friendly development environment, that actively assists the user with Intellisense (command completion) and context-sensitive help. Small Basic contains built-in classes for easy manipulation of graphics, sound and animation, and the syntax follows the usual object-oriented notation, but without the "clutter" typical for C#.

The most important difference between C# and Small Basic is that in Small Basic, programs are much simpler than in C#:

```
TextWindow.Write("Enter n:")
n = TextWindow.ReadNumber()
For i = 1 To n
  TextWindow.WriteLine(i + "^2 = "
                + Math.Power(i, 2))
EndFor
```

Figure 1. Example code in Small Basic

The same code in C# is significantly longer and with more statements (Figure 2).

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;

namespace ConsoleApplication1
{
   class Program
   {
      static void Main(string[] args)
      {
          Console.Write("Enter n:");
          int n = int.Parse(

Console.ReadLine());
          for (int i = 1; i <= n; i++)
          {
              Console.WriteLine("{0}^2     =
{1}",
                                i,    Math.Pow(i,
2));
          }
      }
   }
}
```

Figure 2. Example code in C#

It is easy to observe that while the examples in both programming languages perform the same operations, the code in Small Basic contains only the essential keywords and statements and is much easier to read and understand.

III. THE COURSE

The course Programming 2 is optional. This course is aimed towards developing general programming skills and building a foundation for scientific applications of programming, such as numerical algorithms, processing of experimental data, control of external programs and code libraries of scientific functions. Therefore, the curriculum for this course differs significantly from the curriculum of the similarly named course for the students of Computer Science.

The course covers the following topics:

1. Data types and variables
2. Sequential program flow
3. Mathematical functions
4. Branching and loops
5. Arrays
6. Subroutines (with and without return values)
7. Collections (List, Dictionary)
8. Classes
9. File input/output
10. Control of external programs
11. Writing and using function libraries

The course is taught in the second semester (2+2 classes per week). The course is realized through:

- Theoretical classes – covers theoretical topics through regular teaching classes;
- Work in computer laboratory.

The teaching team consists of a teaching professor and a teaching assistant. The professor has an extensive experience in teaching a wide range of programming topics, as well as in object-oriented software development. The assistant also has several years of experience in teaching and software development. The professor delivered the course materials through lectures. The teaching assistant worked closely with the students in the laboratory and during contact hours.

Introductory curriculum topics are based on the book [13], and the Serbian translation [14]. Additional materials and lecture notes are handed out to the students through our website during the semester. For Small Basic, additional tutorials from the website [17] were used.

IV. THE EXPERIMENT

During school year 2010/2011, a total of 110 students of Mathematics attended the course. The students were divided into two groups:

- Group 1, that was taught in C# exclusively (52 students);

- Group 2, that started with Small Basic, covering topics 1-6 in the curriculum, and then transitioned to C# (58 students).

During the first 7 weeks of the semester, both groups were taught topics 1 through 6, but in different programming languages. The topics that were covered up to that point are essentially a basic course in procedural programming, which was taught in C# to Group 1 and in Small Basic to Group 2.

In order to ensure similar program structure in both languages, we implemented all C# programs in a single class. In both programming languages static methods were used, such as Console.WriteLine in C# and TextWindows.WriteLine in Small Basic, and also static properties, such as Console.Title in C# and TextWindow.Title in Small Basic, but these were taught to the students without delving too deep in object-oriented terminology. The Math class was also covered in both programming languages. The topic on subroutines (methods) was covered using static methods in C#. The only time we used the "new" keyword in C# was to create arrays. Special attention was devoted to demonstrating to the students how development environments for both languages actively help by offering command completion and context-sensitive help (IntelliSense).

The first questionnaire (Figure 3) was given to the students in the fourth week. The purpose of this questionnaire was to determine knowledge level the students brought from the secondary school. For the sake of brevity, the first questionnaire is presented together with the results. It should be noted that the first questionnaire was given four weeks into the course, immediately after the lecture on branching and loops (Topic 4). It is therefore alarming that only 32% of the students had solved the problem given in question 4.

1. Self-assessment of your programming skills:
   a. None..... 25%
   b. Beginner..... 63%
   c. Good 9%
   d. Advanced 3%
2. Which programming languages can you use:
   a. Basic *5%*
   b. Fortran *0%*
   c. Pascal/Modula *38%*
   d. C or C++ *7%*
   e. Java *1%*
   f. C# *0%*
   g. Matlab..... *48%*
   h. Other..... *1%*
3. Write a program that will read three numbers and display the largest of them.

   40% solved the problem
4. Write a program that will read numbers from the keyboard until zero is entered.

   32% solved the *problem*

Figure 3. The first questionnaire with results

The first quiz (Figure 4) was given in the eighth week to both groups. The purpose of this quiz was to measure students' progress during the first half of the course.

During weeks 9-10, Group 2 was taught the differences between C# and Small Basic. The students from Group 2 were instructed how to create a Console Application project, declare variables and create arrays, use static methods from the Console and Math classes and write static methods. Since the fundamentals of procedural programming apply to both C# and Small Basic, we considered two lectures of two hours each to be enough to make the transition from Small Basic to C#.

In week 11, a second quiz was given to Group 2. It contained the same number of exercises at the same level of difficulty, but this time in C# instead of Small Basic. Our goal was to determine whether the students can successfully transition from Small Basic to C#.

1. Write a program that will read numbers *a* and *b* and display *a* to the power of *b*.
2. Write a method (subroutine) that will accept one numeric parameter and test whether it is positive.
3. Write a program that will read an array of numbers and display how many of them are positive and negative. Input stops when zero is entered. Use the program from Exercise 2 to test the numbers.

Figure 4. The first quiz

We considered scores from 0 to 3 points as failure, and above 7 points as good. First we compared the results from Quiz 1 between groups (Figure 5). More than 30% of the students from Group 1 failed the first quiz, and about 42% scored more than 7 points. The students from Group 2 fared significantly better, with less than 10% failing and about 67% scoring more than 7 points. This demonstrates that Small Basic is well suited for beginners, as students from Group 1 have had problems coping with C# syntax and debugging.

Figure 6 shows the comparison of results after Group 2 transitioned to C#. This time it is evident that more students from Group 2 (about 25%) have failed the test, with the majority of the rest scoring either lower or higher than in the previous quiz. Those students who scored lower obviously encountered the same problems with the more complex syntax of C#. Also they failed to recognize the need for additional study between the quizzes. The students that scored higher (about 32% with score of 14 and above) have successfully transitioned from Small Basic, but this clearly required additional effort on their part.

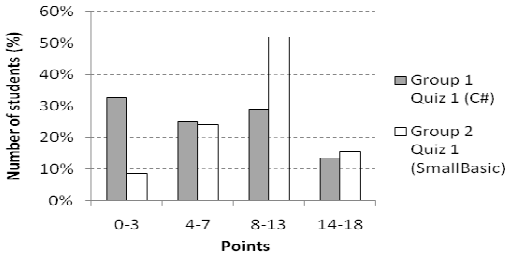

Figure 5. Quiz results for both groups (C# and Small Basic)

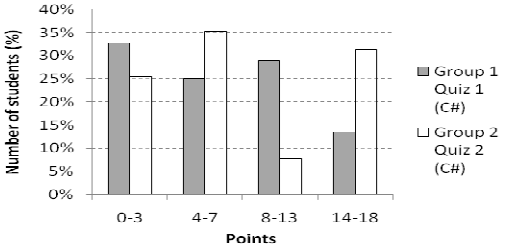

Figure 6. Quiz results for both groups (C#)

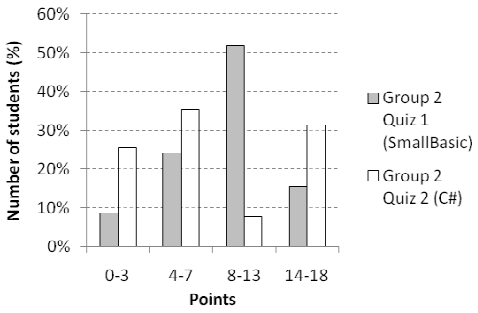

Figure 6. Quiz results for Group 2 (Small Basic and C#)

V. STUDENTS' OPINIONS

We were interested in the students' opinions about the programming languages they were taught to, and also in their work habits. The second questionnaire was given to Group 2 after the quizzes (Figure 7).

1. Which programming language do you prefer: C# or Small Basic?
2. Your reasons for choosing a particular programming language?
3. Was the transition from Small Basic to C# difficult?
4. Why was the transition from Small Basic to C# difficult?
5. Things you like in the Small Basic development environment?
6. Things you like in the Visual C# Express development environment?
7. Did you use the book "C# Step by Step"?
8. Did you use Microsoft's website to learn how to program?
9. Did you use independent websites to learn how to program?
10. Did you use examples and lecture notes provided by the professor and the assistant?

Figure 7. The second questionnaire

91.4% of all students responded that they prefer Small Basic to C#, with the following explanations:

- Small Basic is easier to program in
- The syntax of Small Basic is simpler
- No strict type checking
- All variables are global

- The development environment is simple and uncluttered
- The development environment helps with writing correct syntax

It is therefore expected that 79.4% of the students consider the transition to C# difficult. The more complex syntax of C# conforms to opinions found in the literature. Small Basic was designed with ease of learning in mind, while C# was not. The students' weaker results in C# can partly be attributed to the complexity of C#, and partly to lack of effort on their part.

Another significant problem is students' poor knowledge of English. Because of that, most students do not understand error messages displayed by the compiler. They then try to guess the causes of the errors, thereby making the programming and debugging a tedious process, in which programs either work or refuse to work "for no obvious reason".

An unpleasant surprise was that only 5.7% of the students have been using the recommended book for study. Some of the students complained that the book is only available in English, which shows lack of attention on students' part, as both versions of the book, Serbian and English, had been recommended to them in the introductory lecture and also mentioned several times during the semester. Exactly the same percentage of the students (5.7%) had been using Microsoft's and independent websites for learning. All of the students (100%) had been using examples and lecture notes.

The questionnaire showed that the majority of the students limit their attention mostly to the examples which have been demonstrated in the computer laboratory, and are unwilling to invest additional effort into studying the recommended literature and websites. The curriculum was criticized as being too difficult by the students. Some of the additional comments given by the students are:

- The students would like to learn only Small Basic, without having to learn C#;
- Programming 2 is an optional course, therefore it should be easier;
- The curriculum should be cut or revised to be less difficult.

Only a small percent of the students expressed the interest in learning advanced topics. Those were the same students that have been using the literature, and that scored best in the quizzes.

VI. CONCLUSIONS

Several conclusions can be drawn from the experiment. As Programming 2 is an optional course, the students should be able to determine whether it is suited to their interests, needs and knowledge level. However, first year students are not always able to make a competent evaluation. Moreover, some students do not even understand the differences between compulsory and optional courses. These students expect the optional courses to be easier than compulsory ones. Furthermore, it was shown that the students' work habits are not satisfactory, as most of them did not use any additional materials for study, besides the examples and notes from the classes. Also, a very small number of students used the allocated student hours.

The students preferred Small Basic to C#, which was expected, because it is simpler and easier to learn. However, Small Basic is much more limited in real-world applications than C#, which is an industry standard programming language. Learning C# is thus inevitable. The only question that remains is whether it is more efficient to start learning with Small Basic and later transition to C#, versus starting with C#.

The answers to questionnaires point to several new directions our investigation may take. For example, a more in-depth study of programming skills brought from the secondary schools should be conveyed.

Considering that a significant number of our students scored lower than we expected, and that they were passive and unmotivated, we came to a conclusion that many students chose Programming 2 only because they expected to pass the exam without too much effort. On the other hand, a small number of students worked hard during the semester and, as a result, their grades improved in the second quiz. This shows that low grades obtained in the quizzes stem rather from the passivity and lack of effort on students' part, than from the difficult curriculum.

In regard to the choice of the first programming language, it was confirmed that Small Basic indeed is easier to learn than C#, but it was also shown that the low grades in C# stem at least partly from the students' lack of effort and not from the complexity of the language.

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COMPUTER SIMULATIONS IN SCIENTIFIC METHOD-BASED INQUIRY IN LEARNING CHEMISTRY: AN EXAMPLE OF A LESSON SCENARIO

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Abstract – This paper illustrates the possibility to conduct computer simulations during application of scientific method based inquiry in teaching and learning chemistry. A 20-steps scenario for the lesson "Electrochemical series of metals is presented" which includes application of several computer simulations. In this case, using simulations has benefits over conducting real-time chemical experiments such as: time planning, lower price, lower danger for students due to toxicity of some substances, possibility of visualization of abstract and submicroscopic phenomena and higher motivation of students to study chemistry.

I. INTRODUCTION

Occurring on a molecular level in many chemical phenomena makes learning chemistry difficult [1]. For this reason, students develop scientifically unacceptable conceptions about many subjects or concepts in chemistry. Their knowledge of chemistry is therefore incomplete and incoherent [2]. Many students, in fact, merely memorize chemistry concepts without actually learning them [3]. This situation is an indication of why some students never come to like chemistry.

Advances in technology and science have drawn attention to technological tools that appeal to the sense organs and require interaction with the learner in educational environments. Alternative learning methods such as animation, simulation, video, multimedia and other similar technological tools have become more important in chemistry education. A computer simulation (or "sim") is an attempt to model a real-life or hypothetical situation on a computer so that it can be studied to see how the system works. By changing variables, predictions may be made about the behaviour of the system. Multimedia computer-based simulated laboratory experiments can give students the opportunity to design and carry out many experiments in chemistry in a short period of time.

Computer simulations can also contribute to implementation of scientific method in the process of learning. The scientists, in an attempt to find the most accurate answers to questions about the nature of things and events in their surroundings, adopt a systematic method of enquiry known as the scientific method. The scientific method is a process for experimentation that is used to explore observations and answer questions. Scientists use the scientific method to search for cause-and-effect relationships in nature.

Scientific method refers to a body of techniques for investigating phenomena, acquiring new knowledge, or correcting and integrating previous knowledge [4]. When

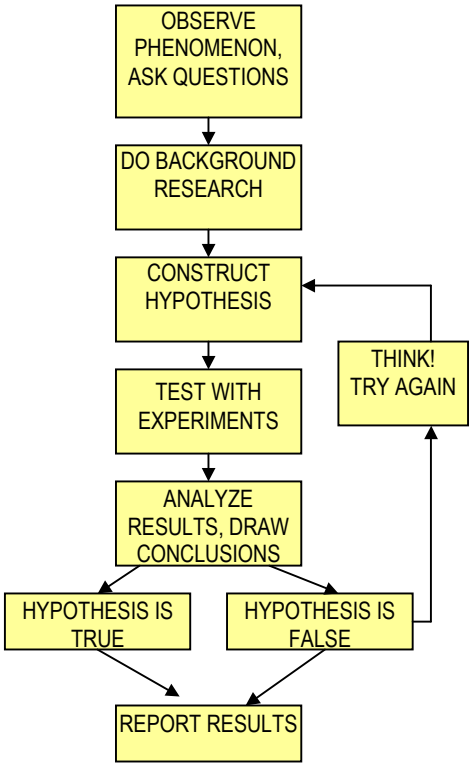

Fig. 1. Stages in scientific method-based inquiry

performing scientific method-based inquiry, one should follow the pattern which involves several stages (Fig. 1):

II METHODOLOGY

The aim of this work was to illustrate the possibility of conducting computer simulations when applying the scientific method-based inquiries in teaching and learning chemistry in secondary education. Many students in secondary school and in the universities have a lot of difficulties in understanding chemistry [5], such as topics related to redox potential of different metals and their reactivity, so the simulations were selected to illustrate reactions

Fig.2. Reaction of zinc with hydrochloric acid

of metals with acids and with compounds of other metals. The simulations used were downloaded from the University of Iowa website [6]; they were interactive open-source materials distributed free of charge for educational purposes. The lesson scenario given below is designed to cover educational content for the secondary-school general chemistry lesson "Electrochemical series of metals".

III LESSON SCENARIO: ELECTROCHEMICAL SERIES OF METALS

1) *Phenomenon observation and background research:* a teacher conducts an experiment (or plays a movie for the experiment, Fig. 2) in which zinc metal reacts with hydrochloric acid (HCl) in a test tube.

Metal reacts vigorously with the acid and gas is produced. Students write the equation of this reaction ($Zn + 2\ HCl \rightarrow H_2 + ZnCl_2$) and conclude that hydrogen is produced in a redox reaction in which hydrogen ions are reduced to hydrogen gas, and metal is oxidized.

2) *Hypothesis (1)*: All metals produce hydrogen gas in reaction with hydrochloric acid.

3) *Planning experiments (1)*: The same experiment should be repeated with different metals (iron, magnesium, tin, lead, nickel, silver, copper).

4) *Experiments (1):* Computer simulation (redox_grp2.swf, Activity 4, [6]) is applied to simulate chemical reactions of zinc, iron, magnesium, tin, lead, nickel, silver and copper with HCl (Fig. 3). Students observe that copper and silver do not react with hydrochloric acid.

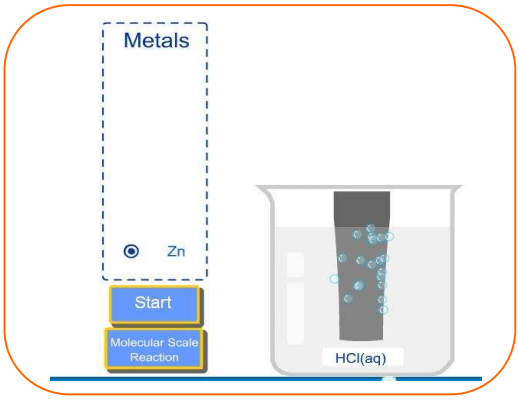

Fig. 3. Sumulated reaction of zinc with hydrochlorid acid

5. *Hypothesis (1) is rejected.*

6. *Hypothesis (2):* Some metals have the ability to reduce hydrogen ions from HCl, and some don't.

7. *Planning experiments (2):* Observe submicro-scopic representations of reactions between hydrogen ions and metals (listed under step 4).

8. *Experiments (2):* Computer simulations (Zn-H.swf, Ag-H.swf, Cu-H.swf, Pb.swf, Fe-H.swf, Mg-H.swf, Ni-H.swf, and Sn-H.swf [6]) are performed. Students notice that hydrogen molecules are formed in redox reactions between all metals and H^+ ions, except in case of copper and silver (Fig. 4).

9. *Hypothesis (2) is justified.*

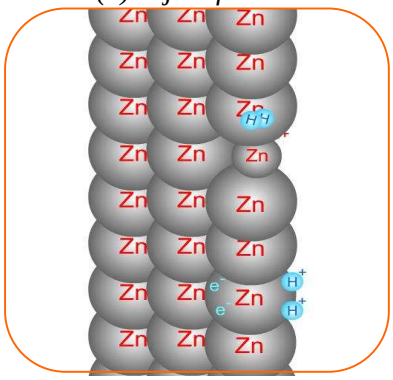

Fig. 4. Submicroscopic view of reaction between hydrogen ions and zinc

10. *Conclusion (1):* Some metals can reduce H^+ ions from acids, which means that they have more negative redox potential than hydrogen. Metals with negative potential can replace hydrogen ions from acids and produce salts. Metals with more positive redox potential than hydrogen cannot replace hydrogen ions in acids.

11. *Hypothesis (3):* Metals have different redox potentials. Some metals are more reactive than others. More reactive metals can displace other metal ions from their compounds.

12. *Planning experiments (3):* Observe macroscopic and submictroscopic representations of reactions between metals (zinc, iron, magnesium, tin, lead, nickel, silver and copper) and salts of these metals in different combinations. A piece of metal (Cu, Zn, Ag, Pb) is placed in an aqueous solution of a metal ion (Cu^{2+}, Zn^{2+}, Ag^+, or Pb^{2+}). This set of experiments may be used to rank the metal ions in order of reduction potential.

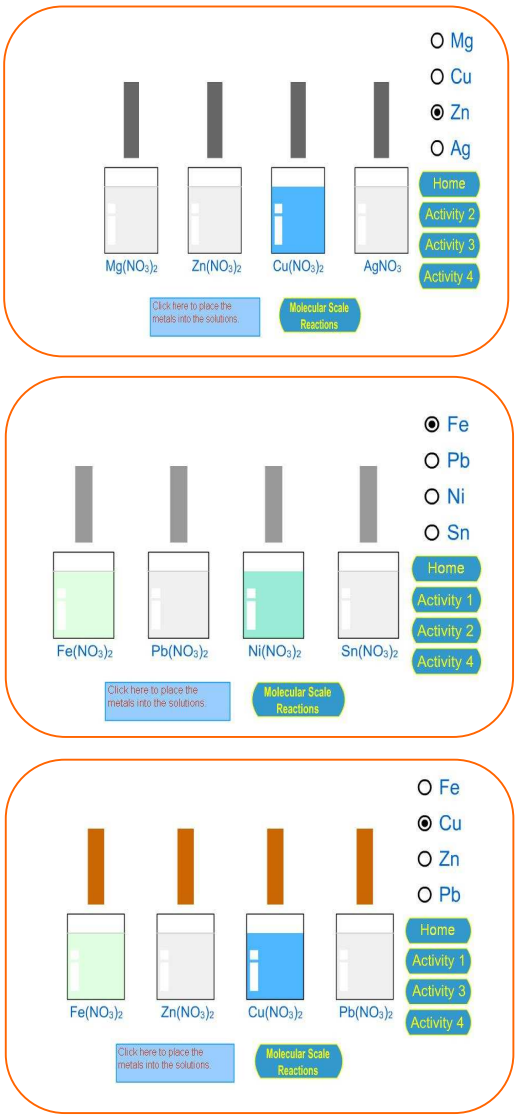

Fig. 5. Macroscopic simulation of reaction between metals and some metallic salts

13. *Experiments (3):* a) Use computer simulations (redox_grp1.swf, redox_grp2.swf, redox_grp3.swf, redox_grp4.swf, [6]) in which metals zinc, iron, magnesium, tin, lead, nickel, silver and copper are dipped into solutions of their salts (as shown in Fig 5). Observe in which cases reaction occurs.

b) Show simulations of experiments on the molecular scale to illustrate redox processes between atoms of the one metal and ions of the other metal in a solution (Fig. 5). The following simulations [6] are used, with option "View molecular scale reactions":

- redox_grp1.swf,
- redox_grp2.swf,
- redox_grp3.swf,
- redox_grp4.swf.

Students notice that more reactive metals can displace less reactive metals from their solutions, and the opposite reaction does not happen.

14. *Hypothesis (3) is justified.*

15. *Results and conclusion (2)*: Students

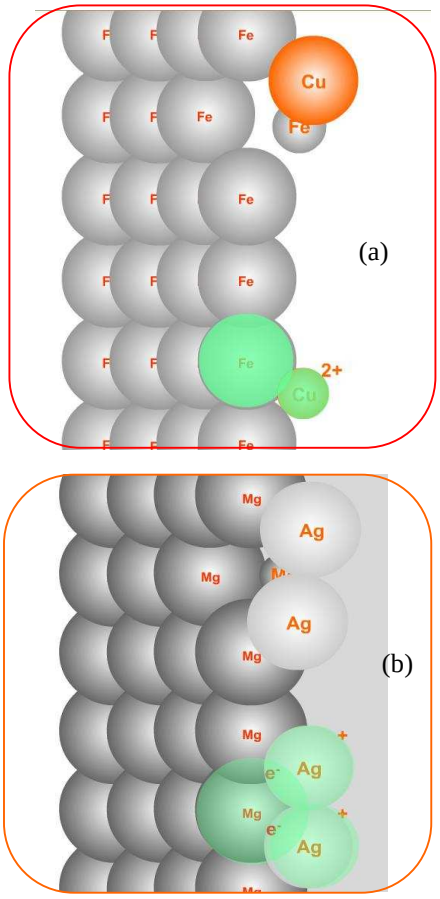

Fig. 6. Submicroscopic simulation of reaction between:
a) copper ions and iron metal
b) silver ions and magnesium metal

notice that reactions occur in certain combinations of metals/metal ions, as shown in Table 1.:

TABLE I. RESULTS OF OBSERVATION OF MACROSCOPIC SIMULATIONS OF EXPERIMENTS

EXPERIMENT 3.1.			EXPERIMENT 3.2			EXPERIMENT 3.3		
metal	salt	reaction occurs	metal	salt	reaction occurs	metal	salt	reaction occurs
Mg	$Zn(NO_3)_2$	YES	Fe	$Zn(NO_3)_2$	NO	Fe	$Pb(NO_3)_2$	YES
	$Cu(NO_3)_2$	YES		$Cu(NO_3)_2$	YES		$Ni(NO_3)_2$	YES
	$AgNO_3$	YES		$Pb(NO_3)_2$	YES		$Sn(NO_3)_2$	YES
Cu	$Mg(NO_3)_2$	NO	Cu	$Fe(NO_3)_2$	NO	Pb	$Fe(NO_3)_2$	NO
	$Zn(NO_3)_2$	NO		$Zn(NO_3)_2$	NO		$Ni(NO_3)_2$	NO
	$AgNO_3$	YES		$Pb(NO_3)_2$	NO		$Sn(NO_3)_2$	NO
Zn	$Mg(NO_3)_2$	NO	Zn	$Fe(NO_3)_2$	YES	Ni	$Fe(NO_3)_2$	NO
	$Cu(NO_3)_2$	YES		$Cu(NO_3)_2$	YES		$Pb(NO_3)_2$	YES
	$AgNO_3$	YES		$Pb(NO_3)_2$	YES		$Sn(NO_3)_2$	YES
Ag	$Mg(NO_3)_2$	NO	Pb	$Fe(NO_3)_2$	NO	Sn	$Fe(NO_3)_2$	NO
	$Zn(NO_3)_2$	NO		$Zn(NO_3)_2$	NO		$Pb(NO_3)_2$	YES
	$Cu(NO_3)_2$	NO		$Cu(NO_3)_2$	YES		$Ni(NO_3)_2$	NO

16. *Hypothesis (4):* Metals (and hydrogen) can be arranged into a series according to their decreasing reactivity.

17. *Planning and conducting experiments (4):* On the basis of the results obtained in *Experiment (3)* solve the tasks given in computer simulations (rank1.swf, rank2.swf, rank3.swf, [6]), Fig. 7. Use your solutions to form a series.

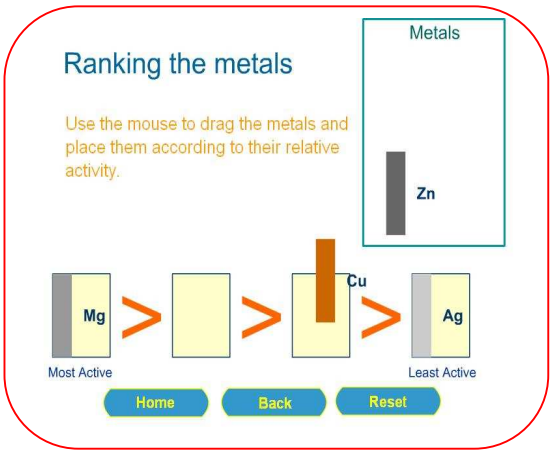

Figure 7. Problem 1: Arrange the given four metals into a series according to their decreased reactivity

18. *Hypothesis (4) is justified.*

19. *Conclusion (3):* Metals used in the experiments can be arranged into a series as follows:

$$Mg > Zn > Fe > Ni > Sn > Pb > H > Cu > Ag$$

20. *Generalization:* Teacher explains that the obtained series a part of a more complex series, which is called "Electrochemical series of metals". Teacher produces a list of redox potentials of most common metals and compares it with the students' results.

IV CONCLUSION

The twenty-steps-scenario presented in this paper can be used to effectively conduct a scientific method-based inquiry during the lesson "Electrochemical series of metals". Computer simulations have a number of advantages over conducting laboratory experiments in ths particular lesson:

1) Real-time laboratory experiments between metals and metallic salts are time-consuming – each experiment takes several hours to several days. This they cannot be conducted during a single, 45-minute class;

2) Some of the compounds used in this scenario are not available in all school laboratories, due to their price (e.g. silver nitrate) or their toxicity (e.g. lead and lead compounds);

3) Experiments can be simulated not only at the mactroscopic scale, but also at the submicroscopic level, which enables students to get an insight into the

processes that happen between atoms, ions and molecules. With the benefits discussed above, another advantage of educational computer simulation becomes quite apparent - computer simulation is highly motivating to learners. Students in a learning environment integrated with computer simulation have higher motivation towards learning, because computer simulation is not only more interesting, but it offers them a unique way to access, interact with and understand the otherwise inaccessible or complex phenomena

AKNOWLEDGEMENTS

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E-MATERIAL FOR LEARNING WORD-FORMATION IN SERBIAN

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Abstract – This work presents specifically implementation of information technologies achievements on content of word-formation in Serbian. E-material for learning word-formation in primary and secondary schools is created in accordance with program requirements. Designed e-material represents model for programmed teaching of grammar and, in that form, it can be used for methodical shaping of contents for other linguistic disciplines and more.

I. INTRODUCTION

Nowadays, to talk about the use of information technology[1] (IT) in different areas of people's life and living is superfluous. IT has its application in education as well, in wide range too. For example, like general information source (Internet), for communication (between teachers, pupils and parents), for presentation and promotion of educational institutions, for curriculum and other educational material preview etc.

One of the useful IT applications in education is creation of learning material, i.e. material for rehearsal and systematization of lessons and knowledge testing. Such material is in accordance with certain psychological learning theories, as well as didactical theories and IT, and satisfies modern programmed learning requirements in the highest level.[2]

According to the concept of programmed teaching shaping and structuring of learning material into electronic form, represent its fullest realization, as well as representation of learning process based on this didactically-methodical system.

This work represents: basic learning elements in programmed learning system, features of developed e-material for learning word-formation in Serbian in primary and secondary schools and possibilities for further work.

II. ABOUT PROGRAMMED TEACHING

One of the modern learning forms is certainly programmed teaching. Necessary elements for complete implementation of programmed teaching are: computer and specially shaped learning material. For implementation of this teaching method schools must have technical equipment and teachers should be capable of contemporary working condition.

Programmed teaching provides high level of individualization, as well as differentiation of teaching, which are important demands of modern methodic. One of its methods is self-learning with specially structured material, and technology as well. Basic nature of individualized method is primarily concerned about teaching content. Namely, teaching content is divided into small units with clearly defined learning goals. The rest is concerned about rehearsal and knowledge verification, which is enabled by frequent testing and other impartial tasks.

Essence of programmed learning is dialogue that, in this case, exists between computer and pupil who answers on asked questions. Teaching material is divided into determinate size steps. Every step gives new information and sets task about them. Next step depends on the solution that pupil gives in the previous one. All the steps are connected into program. Programmed material is divided into sequences and one sequence consists of articles. The article is composed of: information for the pupil, task (stimulus S), pupil, activity (reaction R) and feedback information.

Basic characteristics of the programmed learning are:

[1] Further in this paper Information Technology will be replaced with IT.

[2] "Theoretical basis of programmed learning is in Skiner's psychological theories: theory of corroboration (consciousness about something that is done well positively influences on further activities flow) and theory of staged forming of mentally activities." [1]

1. precise defined program task,
2. systematically elaborated material that is expressed in elementary “doses”,
3. pupil’s activity is provided by tasks for every new part of the material, and the feedback information about correct answer is given right after,
4. pupil’s progression through program depends on previously accepted knowledge in the program,
5. individualization of the working speed is provided, as well as of the method of knowledge acceptance.

In that way, individual work of the pupil, more activity, availability of the feedback information about learning success as well as individualization of the work, are encouraged. [2]

E-material for learning word-formation in primary and secondary schools in some level represents modified programmed learning in the area of the structure and the organization of the material (sequences are not separated particularly and next step in new material is not physically blocked).

According to Adamov and Segedinac, the significant features of good educational material are those that enable independent work, motivate pupils, encourage active and in depth learning as well. [3] By creating e-material for word-formation learning, those high level educational demands should be achieved.

III. About E –material for Primary School

Proposed e-material is prepared in HTML format. This format is chosen because it is commonly known and it has user friendly data preview. Visual preview is defined in accordance with principles of simple and clear data structure. Figure 1 shows first page of programmed material for learning particularly content that is required for primary school.

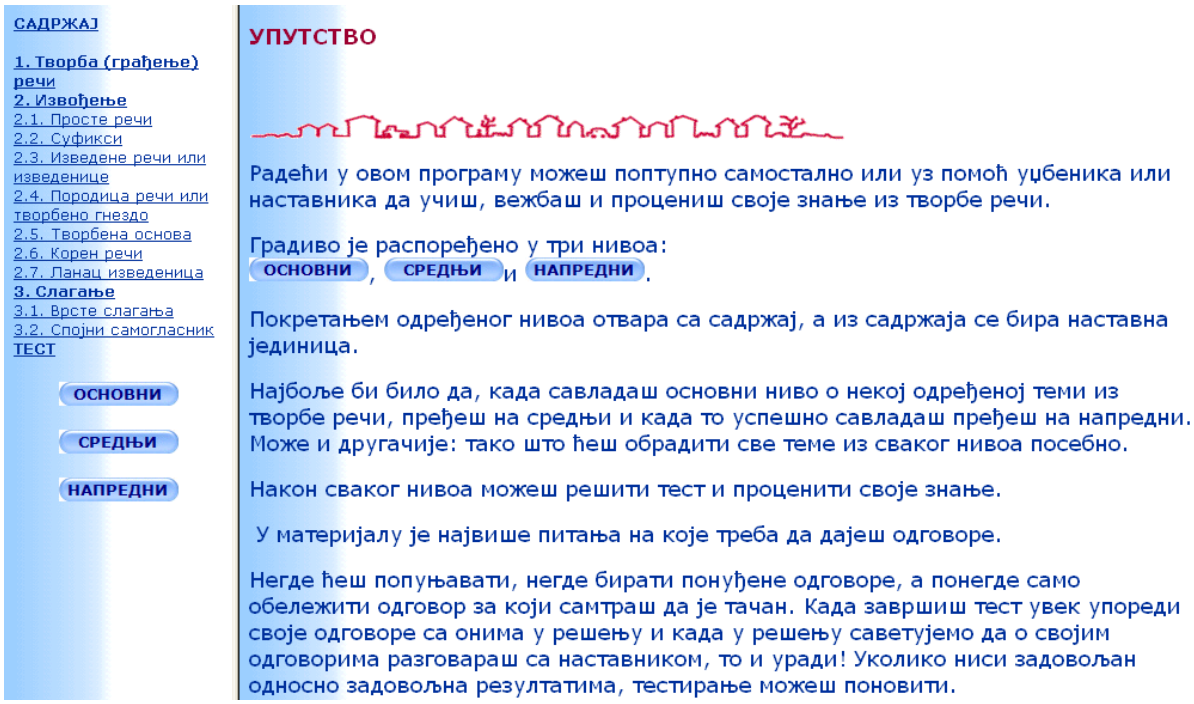

Figure 1. First page of e-material for primary school

Word-formation material for the primary school pupils is organized into three levels: beginner, intermediate and advanced level. Every teaching unit is processed by levels and it is recommended to go through all the levels for each unit. Different kind of application is also possible, and pupil can finish all teaching units from the beginner level, then from the intermediate one and, at the end from the advanced level.

At the end of every level, there is a test. The test has very important and multiple role. Based on feedback information and by solving test, a pupil acquires real insight in his own knowledge about word-formation. Furthermore, the test is a self-evaluation tool, because according to the

point-scale, level of the adopted knowledge can be easily determined. Besides different type of questions, the test contains the following information for pupils: next to the ordinal number of question there is a number of points for correct answer in brackets. Test solution contains point-scale with respectively range of points that are equal to the knowledge grade as well as its level. If pupil is not satisfied with accomplished result he can repeat the test.

E-material contains user manual, table of contents and teaching units. Besides basic information about chosen topic, every teaching unit contains different type of tasks: essay, construction and selection. (Figure 2). Feedback information is contained in the solution that pupil should compare with its own. There are other information in solution, for example instructions about further discussion with teacher, because of topics specificity, or about reading grammar text in relation with those topics.

Methodical-didactical way of material processing for primary as well as for secondary schools has form of learning through discovery and solving problems in combination with the elements of programmed teaching. Teaching material created like this is suitable, not only for learning new lessons, but for rehearsal, practicing and testing as well. E-material is especially efficient in combination with existing textbooks and, in that case, it can be considered as a textbook supplement and it can be used for individual work and progress as well. Namely, it is considered that the combination of classical learning with e-learning is very suitable for efficient way of teaching process advancement in general. [4]

III. ABOUT E-MATERIAL FOR SECONDARY SCHOOL

Word-formation material for secondary school is in accordance with program requirements but, it has different design in contents area and in area of methodical processing in relation to current textbook which authors are Z. Stanojcic and Lj. Popovic. [5]

Teaching material that is represented in form of e-material can be used like information source such as textbook or like working material for rehearsal as well as knowledge testing, according to the fact that it has solution (feedback information) for every task in every lesion.

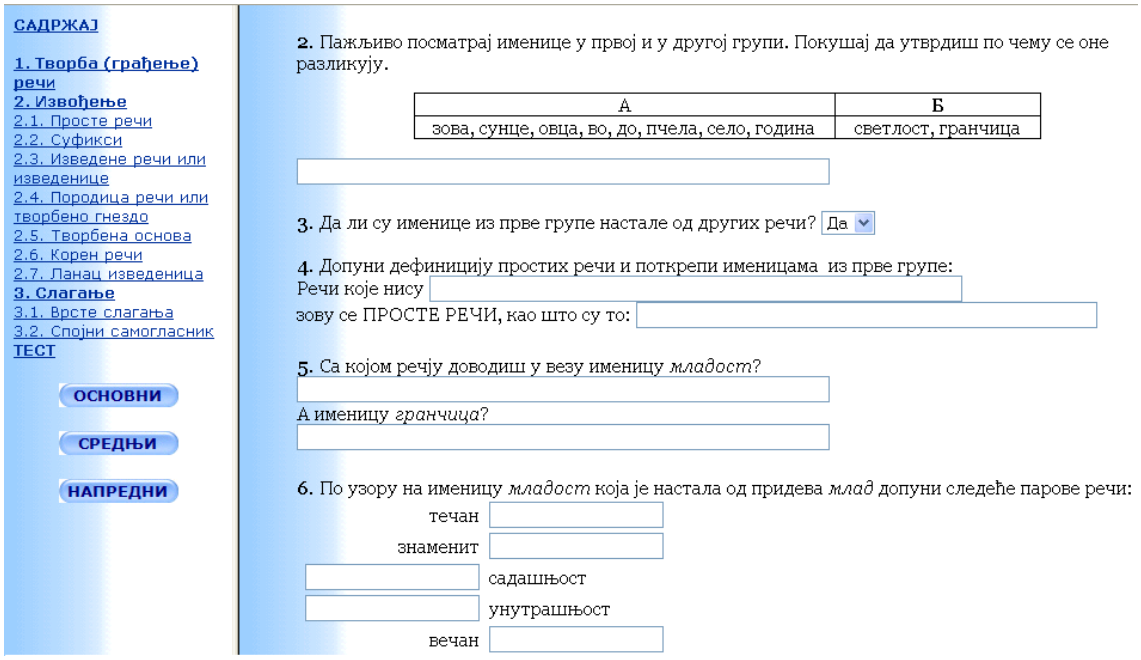

Figure 2. Basic types of tasks in designed e-material

E-material for learning word-formation in secondary school has clearly defined lessons, as well as the content that belongs to them. In the textbook, mentioned above, the whole content about word-formation is divided into three thematic units.

Textbook has concentrated, and with terms satiated text, which is relatively short with sentences that are too long. It has different types

of letters for examples and, terms and important parts of definitions have no color distinction. Textbook does not have schematic preview, neither graphs or tables.

Structure and methodical processing of word-derivation content is partially organized based on deduction, it goes from more general term, i.e. derivation, to the lower range terms such as suffixes and formation basis, as well as to the new words, in order to make turnover towards motivation as highest level term, with a form and semantic review of the link between motive and motivated word.

The left column of the following table includes a content structure according to the textbook, and the right column contains our proposition for content restructuring, which is used for e-material creation. [2]

TABLE I. TEXTBOOK CONTENT STRUCTURE AND PROPOSED CONTENT STRUCTURE

Textbook	Proposition
Derivation	Motivation Motive word and Motivated word
Suffix and formation basis	Formation basis and suffix
New word	Derivation
Motive word and Motivated word	Derivate

E-material lessons have order that follows nature and logic of the derivation processes in Serbian and they start with explaining basic terms and go to the more complex ones. Besides that, tabular and graphic preview show systematic and classified formation units (Figure 3). Pupils should not use data in tables mechanically only to memorize them but, to use them functionally for solving different tasks in accordance to formation segmentation and explanation of the formation meaning of the derivates.


СИСТЕМАТИЗАЦИЈА СУФИКСА ПРЕМА ТВОРБЕНОЈ ОСНОВИ

ИМЕНИЧКИ СУФИКСИ		
За вршиоца радње	-(а)ц -л(а)ц -ач -тељ -ник -ар	писац носилац певач учитељ саветник кувар
Само за жене као вршиоце радње	-ља -ара	ткаља врачара
Суфикси за занимања	-ар -ник -аш -ција -ист(а)	месар наставник кошаркаш јорганција економист(а)

Figure 3. Example of the tabular preview

Content of the lesson mainly includes:

- cognition type of information,
- tasks for gradually addressing of pupils towards individual data discovery, as well as the facts that are important for term's definition,
- definitions of key terms with specially pointing on the information that are important for fully understanding of interpreted phenomena, as well as for understanding of the new material and connecting data and facts into the system (Figure 4).

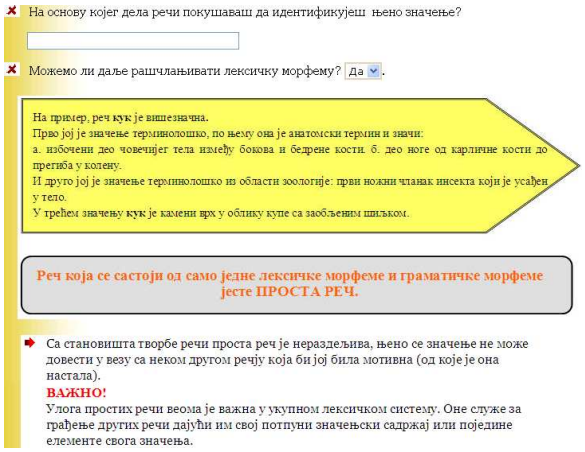

Figure 4. Example of the definitions

IV. EXPERIMENTAL IMPLEMENTATION OF E-MATERIAL

E-material is shown and implemented in different situations, such as seminars for teacher's professionally improvement, as well as for individual work and for preparation of pupils for school contest in Serbian.

Teachers who were included in seminars distributed e-material in approximately twenty primary and secondary schools in Vojvodina and implemented it in real teaching conditions.

Implementation of e-material in individual work came out very useful. A pupil was able to significantly improve its own knowledge about word-formation and to achieve good score in contest. Contents organized by levels especially contribute to self-esteem and self-confidence. Feedback information about success in tasks solving confirms personal capabilities of the pupil and contribute to the development of its competence. It came out that pupils who completed all three levels completely mastered word-formation in accordance with programs requirements.

V. CONCLUSION

IT is positively used for contribution in learning word-formation in Serbian. Chosen format reflects high-quality material which is suitable for every platform. In technical area, requirements for e-material implementation are minimal. They include basic configuration which can run any Internet browser. Result of the IT component of the e-material shows its functionality, simplicity in use and high-quality. [6, 7]

Chosen teaching material corresponds with this way of learning, according to the nature of the derivation processes whose preview can be breakdown and written in symbols, as well as shown by graphs and tables etc.

Efficiency of e-material in teaching is proved by:

- Positive reaction of Serbian teachers in professional seminars;
- Pupil's interest in work with e-material;
- Pupil's high scores in contest;
- This model for e-material can be implemented for material processing in every linguistic discipline and wider;
- E-material can be used for distance learning as well.

This paper proves importance of the team work and shows that interdisciplinary gathering in science is necessary.

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INFORMATION LITERACY AS A KEY COMPETENCE OF CONTINUING EDUCATION

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Abstract - Trends in countries shows that education and the creation of human resources are among the top priorities of national strategies and policies of social, economic and technological progress. Continued socio-economic changes, rapid scientific and technological development require a population that is able to effectively participate in social processes and uses available technology.
It requires that students and teachers become more intimate with information technology, preparing for solving technical problems that thirst to experience, trained in the new mode of communication that thirst be used, and to play an active role in learning and taking responsibility for their own learning.
That is, it is necessary to enable students and teachers to recognize and use information. The paper presents research whether teachers possess information literacy. Also determine whether the implementation of certain standards in teacher training programs can be achieved by raising the level of computer literacy.

I INTRODUCTION

Strategy and the concept of learning has become a major determinant of social, civil and educational policies in the world. Its feasibility depends on the competence of an individual to navigate in the information environment, possessing skills of finding, selecting, evaluating and timely use of information, word, depends on information literacy.

"Information literacy is the recognition of the need for information and possessing knowledge of how to find, evaluate and use the best and latest information available to solve a specific problem or issued a decision. Sources of information may be different: books, magazines, computer, TV, movies or anything else. Today a special role as a source of information is the Internet."

The concept of information literacy has grown parallel with advances in information and communication technology in the early 70's, and Paul Zurowski first used the term 1974th year.[1]

American Library Association: (ALA), says: "To be information literate, a person must be able to recognize that this is the information needed and then have the ability to locate, evaluate and effectively use the information. "[2]

Finally, 1989 year the report was published in the American Presidential Committee on information literacy which has further emphasized its importance by defining it as "the ability to recognize important information and the ability of its finding, evaluation and effective use" and reiterated that the information literacy skills necessary for lifelong learning life and to form an informed and prosperous citizenship. [2]

Information literacy comprises the following components as part of the educational scheme:

- Clarification and understanding of the requirements problem, or task for which information is search.
- Identifying sources of information and finding them.
- Determining whether the information was useful or not in solving the problem.
- The selected information is organized and processed so that it can develop the knowledge and solutions to problems.
- Information or a solution to present the appropriate audience in an appropriate way.
- Critical evaluation after completing a task and a new understanding of the concept.

From presented conceptual definitions of information literacy, it can be seen that it is a key

competence required for continuing education and subsequently incorporated into the starting point of modern national educational policies and international instruments in the field of education as one of the various forms of literacy for the 21st century. In this context, education becomes a strategically important activity that causes the massification of education, and therefore the change in relation to the issue of who teaches what, how and when to learn.

II LIFELONG EDUCATION

Life Long Learning, or the concept of lifelong education, refers to the idea of learning that lasts a lifetime. These two terms, lifelong education and lifelong learning include one another, as a lifelong education means a system of organizational, administrative, methodological and procedural measures to promote lifelong learning. The basic idea is that there should be an educational system, which shall at all times, every individual, regardless of age or professional status, provide an opportunity to master a new, different and useful knowledge. Also, formal and informal education in this sense considered complementary elements of the same whole. Lifelong education, as well as intensive human resource development, has become a necessary condition for increasing the efficiency of modern society.

Elements underlying the concept of lifelong learning:

- upgrading of all available educational system, including formal educational institutions for primary, secondary and higher education
- exceeding the achievements of formal education, bringing together all relevant institutions, individuals and groups about the learning process
- connecting the components of formal and informal education, creating an "educational system for all" made widely available for all generations of users
- each person can find and recognize the true value of engaging in lifelong education

III COMPUTERISATION OF THE SCHOOL

Computerisation of the school means more efficient organization of the overall educational activities in schools, more rational use of energy all the factors of teaching, extension and education resources more quickly, more efficiently get to the progress of relevant information about students in the learning process.

"Computerisation means static distortion of the current school, which is by nature a conservative institution, and retaining some of the educational models that are long outdated. The school is entering a new practice hard, and when it is accepted, then slowly release it, although this practice is long outdated."[3]

Computerisation of the school is large and very important social and economic task. Students and teachers are training to use all possible resources, and above all, information, and to have adequate computer literacy. Applying information technology to modernize the teaching process is realized through the teacher as the organizer of educational work in schools.

IV TYPES OF LITERACY

Information literacy as an umbrella model is:

A. Library Literacy

Competence to use the library or library literacy is a precursor to computer literacy. It is realized by reference and teaching on the use of a specific library, its services and resources. Today, the educational activities in the library developing more and more toward computer literacy in order to enable adoption of skills to access and use resources regardless of where they are.

B. Media Literacy

Media literacy refers to the ability of "consumption" and thinks critically about the information obtained through the mass media, and today the Internet.

C. Digital literacy

Digital literacy is the ability to locate, organize, understand, evaluate and create information using digital technology. In other words, refers to the ability of reading and understanding of hypertext and multimedia texts, and includes an understanding of images, sounds and text nesekvencijalnog dynamic hypertext.

D. Multimedia Literacy

Multimedia Literacy is a new form of literacy, which was created by the emergence of new forms of communication among people.

Multimedia is media that uses several different types of content while presenting some information. Several of these are already part of a global communication: text, sound, animation, video and interactivity.

Multiliteracy person is defined as someone who is flexible and can understand and use literacy and literacy practice in a wide range of texts and technology in a socially responsible manner, in a world that is socially, culturally and linguistically distinct, and who can fully participate in life as an active and informed citizen.

E. Computer literacy

Computer literacy is defined as the knowledge and ability to effective use of computers and technology in general. It also refers to the degree of skill that one has when using computer programs and other applications that are connected to a computer. Another important component of literacy and knowledge of the computer. Possession of basic computer skills is an important prerequisite for an individual may have in developed countries.

Often is equated with information literacy, however, the fact is that these are two fundamentally different phenomena. While the content deals with information literacy, information relating to technology, infrastructure and technological know-how.

V MODELS AND STANDARDS INFORMATION LITERACY

A. Model of information literacy

Models are the theoretical framework, often based on scientific research activities, and standards form a link to the practical implementation of models of information literacy.

Standards are usually aimed at defining the characteristics of the individual written information, the exhaustive listing of properties, attributes, processes, knowledge, skills, attitudes or beliefs that an individual needs to build.

The models most often mentioned in literature are:

1. Metamodels: model of information retrieval, model-driven research, gathering blueberries model, relational model
2. Contextualized models: the model of six major skills, SCONUL model of information literacy model TFPL Workplace

B. Information Literacy Standards

Three categories, nine standards and twenty-nine indicators are used to describe a person who is IT literate. The first three standards relating to services related to information literacy, and the other two categories are related to independent learning.

Standards related to information literacy - a student who is information literate:

- effective and efficient access to information,
- evaluate information critically and competently,
- use information accurately and creatively.

Standards related to independent learning - the student who knows how to independently learn, is information literate and:

- request information that satisfy their personal interests,
- means to evaluate the literature and information,
- difficult to find quality information.

Standards related to social responsibility - the child who contributes to the educational community and society is information literate and:

- recognizes the importance of information,
- ethics refers to information,
- participate effectively in groups to find and generate information.

VI ECDL STANDARD

Early 1990 was dominated by independent and individual definition, form large businesses or other institutions about what constitutes computer literacy. The European Commission launched in 1995. initiative to increase the level of IT literacy in Europe. Part of this initiative was the proposal to establish a trusteeship that would examine how to achieve and that is derived from the ECDL (European Computer Driving Licence) as standard. Very soon ECDL has been accepted in many countries of Europe and other countries outside Europe and spread as

the standard and method for the adoption of information literacy.

ECDL Basic program consists of seven modules:

- Concepts of Information Technology,
- Use of computers and work with files,
- Word Processing
- Tablelarni calculations,
- Databases,
- Presentations,
- Work on the network and the Internet.

VII ORGANISATION OF RESEARCH

The experiment was conducted in the primary school " Jovan Popovic"; in Novi Sad, Primary School "The First Brigade of Vojvodina" in Novi Sad and the primary school "Milos Crnjanski" in Žabalj the school 2009/2010 year.

The study sample included personnel management, professional services and teaching staff in these schools.

VIII ELABORATION AND RESULTS OF RESEARCH

In accordance with the general methodological approach, this study empirical character. As basic research, techniques in collecting data used to test and interview, and for processing and interpretation of results used statistical methods. The paper presents the research level of computer literacy of teachers in primary schools.

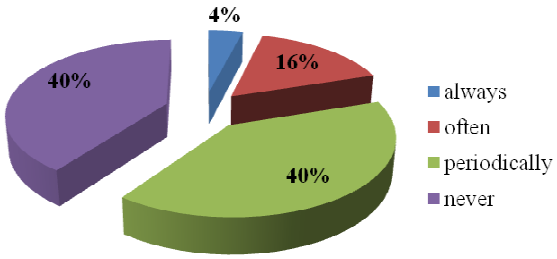

Figure 1. How often use computer during the lessons?

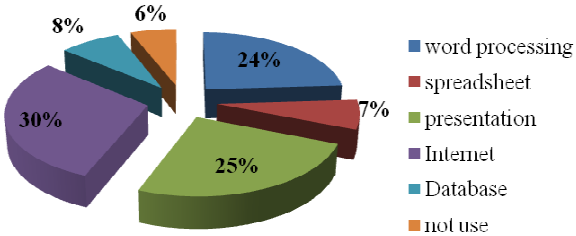

Figure 2. What tools do you use for learning and preparation for teaching?

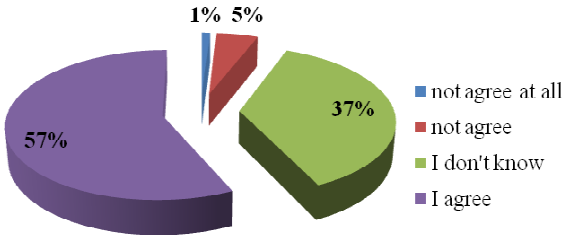

Figure 3. Does use computers in teaching casn raises the level of motivation and student achievement?

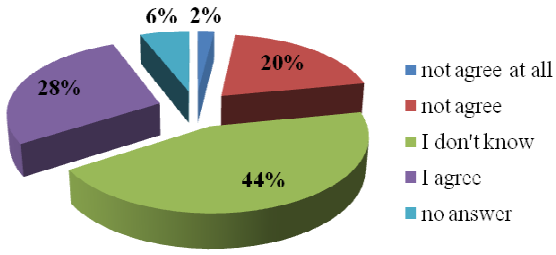

Figure 4. Does ECDL modules set the standard of computer literacy?

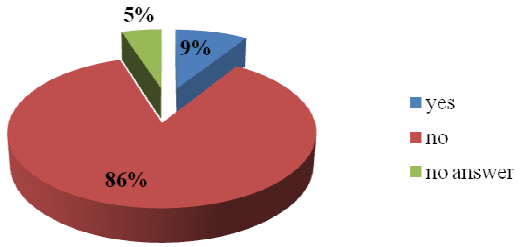

Figure 5. Do you have a certificate of attainment ECDL modules?

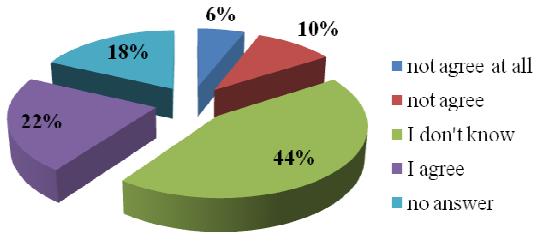

Figure 6. Do you master ECDL modules are used in preparing and executing instruction?

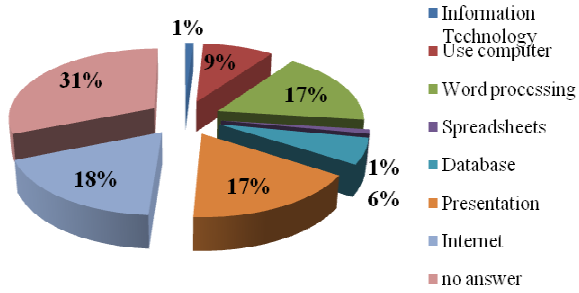

Figure 7. Which of master ECDL module you most use an opportunity of preparing and executing teaching?

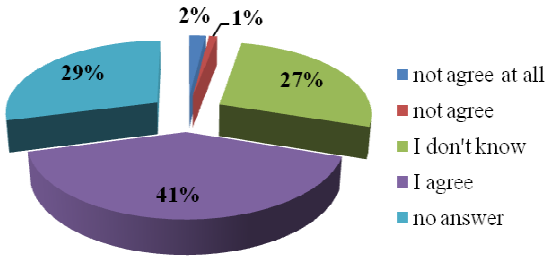

Figure 8. The implementation of the ECDL modules in Computer Science programs would increase the level of computer literacy?

IX RESULTS OF RESEARCH

After conducting a survey among management personnel, professional services and teaching staff in primary schools it can be conclude:

- 92% of respondents use a computer
- Only 32% of the respondents have been taught to use a computer at one of the professional courses under the supervision
- 69% of respondents the motive for training to work on a computer found in the modernization of teaching and acquiring new knowledge, while the rest of 31% motivation was to accumulate a sufficient number of hours required for training and other
- 45% of respondents e-mail is not used or used less frequently than once a week
- 89% of respondents do not use email to communicate with students
- 50% of respondents do not use or rarely use the Internet for personal professional development
- 70% of respondents disagree or not decisive in the assertion that it is well informed about the possibilities of information and communication technologies
- 59% of respondents never or occasionally used a computer to prepare class
- 80% of respondents never or occasionally used the computer during lessons
- 43% of respondents considered, or is reluctant to priimena computer raises the level of motivation and student achievement
- 72% of respondents did not agree, not determined or did not answer to the claim that the ECDL modules set the standard of computer literacy
- 86% of respondents do not have a certificate of attainment ECDL modules and 5% of respondents did not answer this question
- 9% of respondents have a certificate of attainment ECDL modules

Based on the above mentioned facts it is safe to say that the level of computer literacy, from senior management, professional services and teaching staff in primary schools is not a satisfactory.

After creating the test related to the knowledge of information and communication technologies in general, where it was possible to win 24 points by 21 teachers of IT in primary schools, the following results: 1 teacher has won 22 points, five teachers 23 points and 15 teachers maximum points 24 points.

On this basis it can be argued that teachers of Informatics and Computing in primary school have been sufficiently computer literacy, although most do not possess the ECDL certificate.

X CONCLUSION

One of the most important objectives of modern educational practices in the world today is the release of students from learning unnecessary content, except irrational spending time and energy in the final outcome of this process, do not have any positive effect or in any way affect the expansion of their knowledge, skills and skills. This applies especially to the end of compulsory primary education, which for a number of features (along with growth, mental and physical abilities of students...) requires not

only attention and sensitivity of an arrangement of the basic legislative framework but, above all, and carefully selected content should are studied in different subjects prescribed by the Curriculum. As regards the Republic of Serbia and educational practice at this level, the first step has been made very encouraging developing educational standards for the end of compulsory primary education.

It is a known fact that formal education is not able to give young people a full and comprehensive body of knowledge before they start their career. How are learning constantly renew and innovate, the education system constantly has to change. Knowledge transfer became learning and it includes the entire life of the individual and society with its educational, social and economic components.

In the empirical part of this study showed that the level of computer literacy, from senior management, professional services and teaching staff in primary schools is not satisfactory and that the implementation of the ECDL standards in teaching Informatics Program in the school possible.

Computer science and Informatics in the school has the status of an elective subject from the list of V, that is, not even the status of compulsory optional subject.

One of the aims of this study was the one that proves that the teaching of Computer science and informatics in primary school is low and that itself subject to Computer science and Informatics has a well-deserved treatment in the hierarchy of compulsory and optional subjects.

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LEARNING IN ICT ENVIRONMENT

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Abstract – What kind of knowledge is necessary and how should educational system look like in the world characterized by fast technological changes that scientific revolution brings? The machines which can remember, "think" and work more efficiently than people are coming. High technologies ruled by scientific way of work are pushing from historic scene simple and traditional electromechanical technologies of industrial society's physical systems, they are suppressing social manufacturing of classical technologies based on social and technical labour division. High technologies, in work and production, are pushing politechnical educational system whose aim was to give certain knowledge in the function of its application.

The aim of this paper is to try to point at a new ambience which influences the educational system, advantages and disadvantages of uncritical attitude but also at the need that pedagy should offer new solutions.

I. INTRODUCTION

Combination of information and communication technologies has enabled great knowledge improvement.Information are becoming instantenuous and available to all. The gap between possibilities of new technologies and their use in educational process is becoming bigger and bigger. Development of new technologies will go on no metter what benefits will be used in education. It is obvious that current educational system is not aimed to new, the so called Net-generation matured by computers and the Internet.

Inert by its nature, educational system cannot cope with the phenomenon of enormous knowledge increase, requirements of new generations, fast knowledge obsolescence, inadequate technological (digital) literacy of teachers as well as professionals who manage the system. Although technology is present in almost all spheres some researches show that the use of technology in education, among teachers, is far from being the universal phenomenon. Some examples show that there are still teachers who claim that they do not have time to spend in encountering new possibilities they are being offered. Estimating the facts that have contributed to the gap between educational technological means and their usage, *Sharon Kopyc* says that institutions must adopt versatile, flexible strategies in order to encourage more expanded use of technologies in the work of teaching staff. Beside teachers' workshops and technological committees, Kopyc represents further strategies which should be considered by institutions: teachers' educational forums, technological postgraduate programs which offer inaction time and structural support to teachers, as well as other well-timed educational possibilities including time limits, individual needs and personal priorities of teaching staffs' members within the whole institution. *Kopyc* claims that institutions will achieve greater success and use their educational potentials and technological infrastructure by avoiding the universal "one for all" approach to teaching development.

The researches related to the role of technologies in changing and shaping the today's way of learning, tell us about teachers' inadequate use of technologies. Precisely, according to these researches, students want more challenging, technologically oriented educational activities. Software for teaching management that teachers used least was exactly the software which could help students in greatest extent. Students said that their schools and teachers didn't recognize and respond to basic change which had happened to their students and and a learning community although they were responsible for their development.

Scientific society and a completely new civilization different from everything known before have come. In the production characterized by high technological and scientific way of work a new value is consisted of collecting, using, spreading and creating information and knowledge. Instead of economy based on producing goods the new economy, based on knowledge, is coming. Nations whose political elite rejects the old way of production

and directs their societies towards building information scientific society are achieving great economic and other positive results.

II. NEW TECHNOLOGIES IN EDUCATIONAL SYSTEM

Basic information knowledge and skills which information literate person should have are constantly developing and improving because they should follow fast development of information and communication technologies (ICT).

Ten years ago that basic knowledge included: elementary knowledge about computers and the use of operation systems, basic use of program for text processing, table calculators and making presentations. Nowadays, elementary knowledge is consisted of: the use of the Internet and its services, the use of e-mail, the use and browsing of World Wide Web. Even publishing contents by creation of HTML presentations can be considered as basic information knowledge.

Involving new technologies in education has made a new approach to teaching which is called - CMC (Computer Mediated Communication) or communication by the help of computers. CMC can be used in many ways and some of them are the following:

- e-mail and interactive messages,
- discussion groups and forums,
- video conferences,
- on-line catalogs or knowledge bases,
- on-line learning, virtual classrooms and
- programmed archives of data stored on the web (including pictures, sounds, texts videos, etc.).

CMC promotes interaction which does not often find the use in traditional frontal ways of teaching. CMC enables students free searching of alternative ways and finding their own styles of learning. One of the greatest advantages of this way of teaching is that teaching content and everything that follows and supplements it can be available in different forms, at any place and at any time.

ICT helps professional educators to share with their students the tools which will serve as guidelines in the process of their own knowledge development.

However, CMC represents only the first step towards modern education in new technologies environment. It is obvious that innovations enter the teaching process under the influence of extremely fast development of science, technics and technologies as well as development of psychology, pedagogy and didactics. Innovations of educational system assume scientifically based changes in the whole structure of school system – this is where the need for development of modern information school system originated from. Modern, efficient organization and management of pedagogical processes cannot be understood without information system as their management nucleus. The task of school information system is to:

- provide selective and reliable information to its internal and external users, in time,
- contribute to efficiency of pedagogical-organizational school system by providing permanent, necessary information,
- enable improving quality of educational process by offering modern and complete base for teaching and other additional ways of work with students.

III. DIGITALIZATION AND ITS INFLUENCE ON EDUCATION

Knowledge society which is a final objective is based on permanent learning and achieving new skills. Learning is not connected only with educational institutions but independent, individual work in informal sphere of education is expected as well. Libraries are unique institutions available to all people in which accumulated knowledge is almost free of charge. Therefore, their role is becoming more and more important both for development of individuals and the society. Modern libraries must be adjusted to modern times and they should be transformed from silent places, in which books are kept to information centres and meeting places, which are adjusted to needs and wishes of potential customers.

Digital document, a product of information era, a challange of modern times that numerous archives, libraries and museums in the world couldn't resist, represents a new paradigm for current generations of users and researchers of archive material, a paradigm which will be normal and common for future generations. However, although many archives have started

or even finished some digital project it must be said that permanent state of this information technologies module and its application cannot be defined precisely and that it is not treated by archives as a possible replacement for the original or a copy for permanent storage.

Modern information technologies provide easy availability of data in numerous digital formats – qualitative and rare music, books and journals in electronic form and the newest results of scientific researches. Digital archives are characterized by many advantages – some of them are: faster access, bigger capacity for storing information, etc. For all these reasons traditional systems of storing and transferring information are encouraged to change themselves according to new users' requirements and also because of increasing production of printed, audio and video materials. Libraries as institutions represent central places within this process whose objective is managing an enormous corpus of human knowledge, leading, creating and improving the process of presentation, availability and regeneration of information resources.

Although digital technologies have not been used long enough in order to pass the test of time considering permanent state of digital record they are the best solution for their low price, easy use and widespreading. It is sure that in the long run nobody could guarantee durability of CDs or hard discs, so it is necessary to make new copies every five years and even more often. Another limitation that often appears in discussions represents a need for outer devices necessary for using digital collections. Although it is true, the very essence of digital technologies assumes the using of such devices (computers, for example), so in this case we are talking about individual relations towards current trends. A separate chapter should be dedicated to copyrights and their easy misuse on the Internet. Intelectual property represents a base for encouraging creativity so the programs of digitalization must be performed with respect to copyright and similar rights as well.

Nowadays, all kinds of documents are to be found in digital form. “The ammount of information collected in books which have been written since the ancient time up today is enormous: 50 million MB. Digital contents: pictures, video, music, e-mail, web pages, instant messages, phone calls and other digital content which were created, kept and multiplied (three times as an average) in 2006 ammounted to 161 billion gigabyte. It is 24 000 MB information per head in the world or 6 tons of books in 2006 or 3 million times more than the information in all the books written until now. By the end of 2010, according to some analysts it should have been increased by six times - 988 billion GB“. [9]

Some data show that there is a great gap between collective and individual knowledge therefore there is a need for new solutions through new concepts of education.

IV. EDUCATION FOR NET - GENERATION

”Today’s pupils and students are generations grown-up side by side with new technologies. They have been surrounded by computers, video games, digital audio technology, video cameras, mobiles (there are 5 billion mobiles in the world today) and other toys and tools of digital era. An average student spends less than 5.000 hours in reading but more than 10.000 hours in playing video games (and about 20.000 hours in watching TV). Computer games, e-mail, the Internet, mobile phones and direct exchange of messages have become the integral part of their lives.” [7]

Members of the new generation think and process information in drastically different way from their forerunners. These differences are deeper and more serious than expected and even understood by many teachers. Various experiences lead towards different brain structure, says Dr Bruce D. Berry from Medical College Baylor. It is possible that their brain has been changed by the way of their growing-up. Whether it is true or not it is sure that the models of their thinking have been changed.

The members of Net-generation have been used to fast information reception. They process and work several jobs in the same time. They prefer pictures to texts. They are inclined to random approach as in hypertext. They work best in multimedia environment and enjoy in instant pleasures and frequent rewards. They prefer games to serious work.

All those who are not in digital world but they once found themselves there and became enchanted by new technologies and accepted some of their types will always be digital newcomers.

Comparison of characteristics of Net-generation and digital newcomers is presented in the picture 1.

Net-generation	*Digital newcomers*
whiplash speed	conventional speed
multi tasking	mono tasking
not linear approach	linear approach
discontinuous processing of information	processing of individual information
iconic skills	skills-based reading
connected	alone
collaborative	competitive
active	passive
learn to play	separating learning and play
current cost	patience
fantasy	realistic
technology is a friend	technology is the enemy

Figure 1: Comparison of the properties of two generations

The situation is pretty serious because the greatest problem in education is the fact that teachers, who are digital newcomers and speak the language of pre-digital era have to educate the population who speak a completely different language. Teachers, digital newcomers, assume that their students are like those in their time, so they use the same methods that were useful in the time when they were students. This assumption doesn't work any more. Therefore, if we want to educate Net-generation we should face the real problems and cope with them. The following methodology and contents must be considered:

- Methodology: Teachers should learn to communicate in the language and style of their students. It does not mean that they have to change the meaning of important issues or the way of thinking but they should go faster and make bigger steps, in fact they should harmonize their pace with that of their students.
- Contents: After digital wonder two types of contents have appeared: Inherited contents and future contents. Inherited contents involve reading, writing, mathematics, logical thinking, understanding old ideas and records, etc. The whole traditional teaching plan and program are still important but they belong to the past time. Some parts (like logical thinking) will stay important but the others (like Euclid's geometry) will become less important such as Latin and Old Greek. Future contents are mostly digital and technological. While they are involving software, hardware, robotics, nano-technology, genoms, etc., they are also involving ethics, politics, sociology, languages and other similar things. That future content is interesting to students.

In other words, it is necessary to be creative and imaginative but some old knowledge should be used as a base. There are some successful experiences concerning adjustment of materials to the language of net-generation and new solutions are finding out as well.

V. DISTANCE LEARNING AS TECHNOLOGICAL PLATFORM OF THE FUTURE EDUCATION

Distance learning represents establishing connections between people and resources by the help of communication technologies or it can be understood as a type of education in which learning and teaching are separated in time and space permanently or mostly. Improving media for supporting this type of learning as well as theoretical and practical knowledge influenced distance learning that has passed through several

phases – from classical correspondent schools to distance learning aided by IT.

Distance learning concept assumes a great number of factors and they can be classified in several categories:

- elementary information about a school, teaching plan and program, staff, historic background, equipment…
- Teaching material: lessons available on web pages ans files for downloading. They are: presentations, animations, video and audio materials which can be presented in textual form. In addition, links with other Internet pages covering similar themes, similar courses, school media-library, can be offered, too.…
- Interaction with a teacher, as well as on-line access to consultations. They are: information about a suject and a teacher, time table of a teacher, information related to printed material, subject content, marks, teacher's e-mail, discussion groups for communication among students, form for reports about problems.
- system for knowledge validation.

The first group of factors related to distance learning concept is not of great importance for the process of learning but the second and the third group represent the elements of this concept. Final and the most important phase of distance learning concept is evaluation of students' knowledge by teachers. This is the only phase within distance learning concept which requires the presence of teachers and students at a certain location for proper and regular knowledge testing.

Contents which is sent to users in any type of distance learning is of greatest importance. This is the key factor, together with communication with a teacher, concerning learning on the Internet. The contents on Internet pages must be selected carefully and reviewed as well. Available material should include:

- theoretic part for each unit,
- solved tasks for each unit,
- links for pages containing similar material for the given theme,
- pictures and graphs with explanation of necessary steps
- multimedia content and explanations of software packages dealing with relevant themes
- examples of tests (solved tests as well as unsold ones to be solved by students)

All these contents have to be adjusted to concrete users and they also have to be available and appropriate to majority of users. IT technologies offer numerous possibilities to distance learning – they are especially useful to those students who are prevented from regular course attendance for various reasons, so they can continue their courses from home or from other places and in that way they can actively be involved in the learning process.

VI. THE FUTURE OF EDUCATION IN THE ERA OF GENERAL INFORMATION PROCESS

The future of schools in information era can be observed from several angles and two of them are most significant:

The first aspect is technological and schools must accept new technologies in the future which enable easier learning, distance learning, browsing encyclopedic base of knowledge , improving student-student communication, teacher - student communication and teacher - teacher communication by using the newest web and Internet technologies. There is still a danger of uncritical approach and acceptance of the newest technological achievements without any plan and program as well as their implementation in the system.

Numerous researches have showed that learning by the help of various multimedia contents (text, picture, sound) encourages interest and improves students' concentration in general. Schools as institutions which promote knowledge will have to accept the newest trends in data base development because it is the most prosperous and practical way of fast approach to requested information. It will not be possible to follow the trend related to science development without connecting educational institutions by modern communication technologies and backwardness will be bigger and bigger.

The second aspect is pedagogical and sociological. Technologies bring a lot of advantages but a great attention should be paid to implementation of such technologies in education. Implementaion of information process in education must not be transformed into mere

trend and fashion following in the world of computers and IT in general. If this becomes the reality then the very idea of implementing IT and improving education loses its sense. The result of that can be nothing more than some new discovery by the help of a computer.

Therefore it is necessary to make a strategic plan and program for implementing IT in school system and the science because it is the only way for achieving the main objective – improving education by the help of computers.

VII. CONCLUSION

Because of fast development of science and frequent technological changes global society is being constituted as educational, scientific and production system with new educational aims which does not offer knowledge for the current technology but for the future as well, in other words, it gives a life-long knowledge which enables life-long learning and creating.

Within these fast changing conditions high technologies have caused the crisis of education and the society as well. High technologies have brought a new educational aim which can be reflected in offering general, permanent knowledge and the knowledge for scientific work in relation to making and implementing new knowledge. Here comes the society which is learning, working and creating. In such a light development of education should be seen because global society is being constituted as a new educational, scientific and production system.

The future of education in the era of general informatization should:

- improve communication between teachers and students,
- create educational system appropriate to the generation grown-up in digital era,
- invest more in information education of teachers,
- scientifically research from didactic aspect how and in what extent to use possibilities of new technologies in formal and in informal education.

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CONTEXTUAL CONDITIONS OF LEARNING AND TEACHING IN EARLY CHILDHOOD

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Abstract - This paper represents the analysis of personal theory of preschool teacher on the importance of the context of kindergarten in the construction and understanding of learning and teaching of preschool children. Subjective professional concepts of preschool teacher as the representative of institutional context of educational process were observed by the model of qualitative interview. The answers of preschool teachers were classified in the system of categories, whereas their connection was defined with X^2 independence test. The results of X^2 teste were obtained according to the analysis of the relations of the systems of categories at the sample of 35 preschool teachers. The results showed there was significant correlation of the answers to the set of questions typical for the observation of the context and implicit pedagogy of preschool teachers at the significance level p= 0,01. The interpretation of the results leads us to the conclusion that preschool teachers do not use context as means of restructuring of learning and teaching sequences. Therefore, they do not use developmental potentials of the context as the resource in the building of knowledge structures of children at an early age.

I. INTRODUCTION

Definition, structuring, redefinition and restructuring of working and educational conditions represent common concepts in the contemporary discourse of our society. The quality of learning and teaching from an early childhood should try to keep the pace with vast number of information which is multiplied extremely fast. (Parrot, 2002). Therefore, we have to find out the preconditions of efficient and effective educational process at the first level of educational system, in kindergarten, as well as to try to keep educational system up to date with progressive technical, technological and informational development in the 21st century. The greatest variance of this answer could be attributed to professional competencies of preschool teachers, although recent theories and reserch on learning (Barth, 2004., Kovač 1998., Pešić, 1998., Krnjaja 2008., Slunjski, 2006.) claim that learning and teaching are conditioned by the context. Therefore, the aim of this paper was to investigate preschool teachers' understanding of elements and efficency of the teaching process, as well as the understanding of institutional context of kindergarten as developmental potential for learning and teaching. Context as a set of circumstances in social and physical environment represents meaningful entirety of facts and events, which has particular meaning. Meaningful entirety is made by constant connection, mutual conditioning and interaction of elements which form particular meanings. The meaning is created and being changed in the process of interaction of all components. Therefore, each context is unique. This paper is based upon institutional context, as a micro context, which is defined by the structure and the means of space management, time management, relationships among children and the adults, openess of kindergarten to children's needs and to local community. If institutional context of kindergarten is defined in this way, then individual participants in specific environment, with their own needs and conditions to which they are exposed, represent its components. Therefore, institutional context of kindergarten is represented as an educational frame where specific meanings, which child structures as an educational sequence in cognitive, motor and social status, are constructed. Thus, context must be seen as a process, whereas teaching and learning of preschool children represent the construction of meaning.

II. METHOD

The sample included 35 preschool teachers who work in kindergarten „Pčelica" in Sremska Mitrovica. Individual, qualitative interview was used in the investigation of preschool teachers' understanding of relationship between learning and teaching. Four questions were used as a frame for the interview: 1. What is the relationship between learning and teaching in your opinion? 2. What is „good method" of teaching in your opinion? 3. What does represent difficulty to you in the choice of particular teaching method? 4. What does learning and teaching context mean to you? Two researchers interviewed preschool teachers, the author of the paper and doctor of pedagogy. The interview was noted and recorded. The answers of preschool teachers obtained during the qualitative interview were classified in the system of categories, which was structured after the realization of the interview. Descriptive statistical methods of frequency distribution, central tendency measurements and causal non-parametric procedure X^2 test were used for the analysis of the results.

III. RESULTS AND DISCSSION

The results of qualitative interview obtained at the question 1. What is the relationship between learning and teaching in your opinion? show that the greatest number of preschool teachers' answers (39,14%) is related to understanding of the learning and teaching as separate processes, which can be accepted from the point of view which regards learning as internal process, and teaching as creation of external conditions. If frequencies of

answers (Table 1) are compared, it can be noticed that interpretation which considers learning as an active, and teaching as a passvie process has highest frequency (9). The second difference which can be noticed in this category refers to the definition of difeerent areas of learning and teaching, whereas learning is associated with play and building of knowledge, and teaching is associated with giving information, problem solving, habits and skills development.

TABLE 1. What is the relationship between learning and teaching in prechool teachers' opinion?

categories	**preschool teachers' answers**	*f*	∑ *f*	*%*
A)they interpret learning and teaching as identical processes	there is no difference, they are the same	5	5	12,11
B) they interpret learning and teaching as interactive processes which complement each other	-they are dependant on each other, they complement each other -everyone learns through his or her own activity, -preschool teacher ensures conditions and encourages learning	6 2	8	19,51
C)they interpret learning and teaching as processes which are linked in some way	-teaching guides learning -learning is process and inborn need, whereas teaching preceeds learning and it is shorter -learning is basis and teaching is superstructure	6 4 2	12	29,22
D)they interpret them as separate processes	-learnig is active, and teaching is passive process -teaching leads to problem solution, whereas learning is connected with play -learning is active process, whereas teaching represents giving information	9 3 4	16	39,14

Eight preschool teachers of 35 preschool teachers who were interviewed (19,51%) interpret the relationship of learning and teaching as interactive relationship in which these processes complement each other. The answers which describe this interactive relationship as "complementary", "mutualy depending", "the one which creates conditions, encourages", are the most frequent. These descriptions can become basis for understanding of complementary nature of learning and teaching. Five preschool teachers equal learning with teaching and interpret them as idetnical processes. Teaching is understood and programmed as applied learning psychology, whereas practical implications which overcome frames of learning knowledge were not taken into consideration. The second implication of regarding learning and teaching as identical process can be neglection of psychological rules of learning whereas whole attention is paid to teaching solely.

Another important characteristic of relationship between learning and teaching can be functionality of teaching method for maintaining of certain quality of learning. In their interpretation of „good method", preschool teachers had several statements. Their frequency is presented in Table 2. The greatest percent of answers (46,15%) refers to the relationship between „good method" and enabling of quality of learning. The analysis of individual answers shows that preschool teachers use several dimensions in their interpretation of „good method", such as "independence, encouraging of inner motivation, interest, creativity, active realtionship of children in learning process, getting experience". These dimensions represent preschool teachers' assumptions on quality learning, which shows that significant number of preschool teachers is aware of it, but it could also explain their definition of good method which is based upon the quality of learning. From the point of view of practitioners they describe "good method" according to their understanding of quality learning. However, there is a dilemma why preschool teachers do not take the aspect of creation of conditions needed for quality learning into account while considering "good method".

TABLE 2 What is *"good method" in preschool teachers' opinion*?

categories	**preschool teachers' answers**	*f*	∑ *f*	*%*
1) it ensures learning achievement	-it ensures good results -it makes knowledge acqusition easier	3 7	10	25,64
2) it ensures the quality of learning process	-it makes children interested for the activity -it enables children to take active part -it enables children to show their creativity -it satisfies children's needs -it enables children to develop individual traits in the activity -it enables children to experiment -it enables children to get new experience -it ensures good communication with children -it offers choices -it encourages childrens' inner motivation	6 4 1 1 1 1 1 1 1 1	18	46,15
3) method which is good in itself	-play -it enables understanding of a content -it is suitable for particular area -it unites all elements of the method -it represents combination of different methods	4 4 1 1 1	11	28,36

Lower percent of answers (28,36%) refers to interpretation of the method as "*good*" in itself. In their interpretations preschool teachers mention play as the most common means of learning in preschool period. Other answers express connection between "good

method“ and learning content or they associate it with combination of several different methods.

More than 25% of the answers referred to comprehension of “good method“ as the means of ensuring learning achievement. Even if we do not take the type of achievement into consideration, the importance which preschool teachers assign to achievement can have its basis in comprehension of learning as a process of production where “the product“ has the greatest value, whereas “the means of production“ are not important at all.

Environment has the highest frequency (41) in definition of difficulties in the choice of teaching method (Table 3). The lack of materials has the highest frequency (40) in individual comparison of parametres in categories. In additional questions preschool teachers confirmed that commonly used expression “unequipped environment“ includes the lack of “furniture“, as well as the lack of materials, so that they can be analyzed together. Preschool teachers tend to say there is “a lack of materials and equipment“ when they express their attitude on working environment. These answers could lead us to the conclusion that preschool teachers define equipment and materials as significant “in themselves“, and not in the relation to their purpose in stimulating different ways of interaction and different types of children’s learning activities. According to these answers the following question could be asked: In what extent does the lack of equipment and materials represent technical problem in teaching or the problem of preschool teachers’ reflection about the learning process?

Preschool teachers’ answers considering the lack of materials could also show that they believe that only certain materials can help them achieve particular learning goal. Therefore, they associate the lack of materials nad equipment with the lack of learning possibilities, which prevents them from looking for different learning solutions.

TABLE 3 What does make difficulties to preschool teaacher in the choice of learning and teaching method

categories	**preschool teachers’ answers**	***f***	**∑ *f***	**%**
1)space,equipment, materials	-the lack of working materials -working environment is not well equiped - inadequate working environment	19 14 8	41	33,06
2)the number of children	-large number of children in the group	24	24	19,35
3)children’s interests and needs	-different developmental level of children within a group -children of different age within the same group -different interests of children -making a child interested for activity -the lack of motivation -children whose behaviour is inappropriate -children’s mood and health -constant recognition of children’s needs -a child with special needs -the level of children’s previous knowledge -there is no feedback	7 6 6 4 3 3 3 2 3 2 1	40	32,20
4) cooperation	-the lack of cooperation between preschool teachers and parents -environment -child’s unwillingness to cooperate -theory does not keep pace with practice -mutual planning	6 5 2 1 1	15	12,10
5) there are no difficulties	there are no difficulties	4	4	3,22

Large number of children within a group occurs in 19,35% as an obstacle in the choice of teaching method. Preschool teachers’ answers do not give us sufficient information on particular dificulties associated with the number of children, such as social environment organization, time and space menagement. The answers “child shoud be interested in the activity“, “the lack of children’s motivation“, “children whose behaviour is inappropriate“ could lead us to the conclusion that preschool teachers observe children’s learning only from the standing point of teaching. Teaching position is illustrated with words “child should be more interested, the lack of motivation, inappropriate behaviour“ which illustrate preschool teachers failure to make children more interested and motivated for particular activities. Therefore we can conclude that possible solutions should include reconsideration of preschool teachers’ notions on interests and motivation of children in learning process.

21,14% of difficulties were associated with number of children in the group in preschool teachers’ definition of difficulties in the choice of teaching method. Additional statements were “we cannot hear what each child has to say“,“we cannot pay more attention to children who did not comprehend well“,“we cannot deal with observation, and we are asked to do that for each child“, “there are no enough chairs for all children“, “we cannot present everything that children did, there is no enough space“. These answers show that preschool teachers interpret the number of children in relation to environment such as play room and that they think that it is not suitable.

As far as the fourth question (What does learning and teaching context mean to you?) was considered, preschool teachers gave answers which were similar to the answers to the third question. Therefore, it was not difficult to classify parametres of the fourth question since they were almost identical with the parametres related to the previous question.

TABLE 4. WHAT DOES THE CONTEXTOF LEARNING AND TEACHING MEAN TO YOU

CATEGORIES	*PRESHOOL TEACHERS' ANSWERS*	*f*	*Σ f*	*%*
1) space, equipment, materials	- Kinderagarten and its surrounding - working materials - well-equiped working environment	18 10 5	33	40,74
4) cooperation	-cooperation between preschool teacher and parents -environment , local environment	17 10	27	33,33
3) children's interests and needs	-different developmental level of children within a group -children of diffferent age within the same group	10 3	13	16,05
2) the number of children	-the number of children in a group	8	8	9,87

Statisticaly significant correlation of the answers, i.e. systems of categories of the third and the fourth questions was defined by X^2 independence test. The results of X^2 independence test presented in Table 5 show statistical significance at the level 0,01, which leads us to the conclusion that preschool teachers' answers are almost identical when problems of teaching and learning methods and definition of conditions in which these processes take part, i..e. definition of institutional context, are discussed. Therefore, we can conclude that capacities of context for redefinition of learning and teaching conditions in kindergarten are not paid enough attention in initial education.

TABLE 5. RESULTS OF X^2 INDEPENEDENCE TEST

Number of degrees of freedom	12	
X^2 value	25,47	п=0,01
Contingency coefficient	0,251	

IV. CONSCULSION

The relation between "implicit theory on education" (Pešić, 1987) and preschool teacher's practice work is specific and difficult to investigate for other researchers. Preschool teachers analyze their implicit notions using reflexion and reconsideration. Thus, they make it available for self control and change, because "the wholeness of the unconscious cannot be raised to the level of the conscious if it is not changed" (Konig, Zedler, 2001). Institutional context, micro context with its elements such as: environment, time menagement, materials, social environment (cooperative learning, mutual teaching) concepts of those who teach, represents reverse process, insufficiently used resource in knowledge building in early childhood. Pilot investigation in this paper undoubtedly confirms the fact that preschool teachers do not have sufficient knowledge about developmental potentials of micro context as an area for (re)structuringof learning and teaching sequencies, as well as about the role of the context in creation of knowledge structures of children in early childhood.

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TEACHERS' INTERCULTURAL COMPETENCES

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Abstract - During last years one can notice the tendency of changes in the education system of Serbia. On all levels, from pre – school upbringing to university education systemic and structural changes in teaching process and school – work organization take place. One can observe the development of standards for achieving applicable knowledge, competences and skills. Instruments for objective evaluation of the whole quality of education are gradually introduced. The topics of this paper are the problems of intercultural connections and intercultural competences of teachers. Thus, this paper will present the main problems, objectives and tasks necessary for better understanding of mutual cultural connections and interactivities. In the paper there are the answers on these key questions: how can people of different cultures understand one another if they do not have the same cultural experience, and how teachers can help in that inter – cultural process?

I. INTRODUCTION

The concept of culture is defined in different manners. Some people describe it as "whole set of signs by means of which members of a given society recognise one another, and which differ them from the people that do not belong to that society". Culture can as well be designated as a set of distinctive spiritual, material, intelectual and emotional patterns of a society or a group of people, together with their art, literature, life styles, ways of common life, system of values, tradition and belief. Culture is in centre of individual and social identity, and it is main component in understanding of group identities considered from the standpoint of social cohesion. Meditation on culture always leads to consideration of relation, interaction among cultures. Cultural distinctions which we notice among people, enable us to be aware of culture existence, in other words it is impossible to understand culture as an idea in singular, on the contrary, it is always spoken about cultures. (www.most.org.rs)

When one speaks about interculturism, it presents a conception used in majority of European countries. It designates recognition of values, life styles of individuals and society, acknowledgement of distinctness and interaction among cultures.

II. UPBRINGING AND EDUCATION FOR INTERCULTURE ACTIVITIES (INTERACTION OF CULTURES)

There are three basic attitudes first, that education is everyone's right, second, that it increases personal liberties, and third, that it contributes to the development of person (ality). Very important and undisputed fact is that it ought to be inclusive, without segregation referring to (one's) language, ethnicity, capabilities, sex, or regarding any other criterium. Promotion of tolerance and esteem through curriculum has little impact, if it is (being) realized within educational institutions which are essentially intolerant. In accordance with it, it is necessary to execute structural changes in system itself, as well in its parts. The objective of education ought to be realizing of full potentials of every child at school whose climate is distinguished by understanding and respecting varieties. Contemporary, and first of all appropriate education, directed to complete development of every individual, has to exceed the level of transferring the accomplished knowledges, and is focused on accepting the skill "how to learn" and developing capacity how to create new knowledges (Oljača, 2007/2:133).

Cultural differences and their role in every day life inevitably reflect also on the behaviour of pupils and teachers in school. Raising attitudes, capabilities, feelings, manners of existing and behaving towards a person of different culture, diverse than we is particular feature of intercultural upbringing. To be interculturally educated means that a person communicates, but it also listens to "another" person. Therefore the intercultural training should not be considered as training for culture transfer, but as the training that will enrich culture, and approve practical acknowledgement

of universal value – value of an individual, a person respectively.

Intercultural education tends towards overcoming of passive coexistence and realizing a developed and sustainable way of common life in multicultural society. It can be achieved creating understanding, mutual respecting ang and dialogue among groups of different cultures, as well through ensuring equal possibilities and struggle against discrimination. Intercultural education is a process which demands from every person to know him / her self in order to understand the other people's culture. This is a very provocative process, and it comprises work on profoundly ingrained beliefs of good and bad affairs, reconsidering one's own views of world and his / her own life. All that we take for granted in intercultural learning is (being) investigated thoroughly and critically thought out. Intercultural learning is a challenge for personal indentity and it can become the way to enrich our qualities and attidudes. Inasmuch as that intercultural learning is a process through which we learn how to live together in the world of variety, it is with this also the starting point of creating common life in peace. Intercultural education contains *two key domensions*:

1. education that respects and supports distinctiveness in all fields of human life is considered intercultural education. It causes that pupils are sensitive to the idea that people have naturally developed different manners of life, customs and view of the world and that this diversification of human life enriches all of us;
2. simultaneously it is the education that promotes equality of human rights and resists to injustice and discrimination and advances the values on which is (being) built parity (www.most.org.rs).

Intercultural education ought to contribute the fulfillment of these *objectives*:

1. exceeding of social inequality and diversity in education;
2. developing of respect and tolerance towards cultural varieties among people;
3. to help pupils to adopt the knowledge about inter – ethnical relations and bases on which are founded various cultures; learning should not be based on emotional and class assumptions. (Koković, 2009:194).

III. INTERCULTURAL COMPETENCE

Intercultural competences as a dimension of school context are situated into wider reference frame, and it is Education for democratic citizenship. Namely, Education for democratic citizenship is established on several innovative approaches to:

- education for human rights;
- civic education;
- education for peace;
- intercultural education (Kostović,Đermanov, Đukić, 2007:19).

In available literature are present different classifications of intercultural competences. (The) first classification comprises competences which can be classified in:

1. **Cognitive competences** – they can be divided into many subgroups. The first subgroup contains the competences of legal and political nature, in other words knowledges regarding the rules of common co – life (growing close to) and democratic conditions of their establishing; knowledges about democratic public institutions and their role in the function of all citizens. In the second sub – group are the competences relating to the knowledges and capabilities of responsible decision making in democratic society. Then, into the third subgroup can be classified competences of procedural nature for which is characteristical transferability, in other words the possibility of using in different situations. And in the end, the fourth subgroup of cognitive competences belong the knowledges about principles and values of human and democratic civic rights.

2. **Ethical competences** – they present the second group of competences that are founded on the thesis that individuals develop their identities and relations with the others in accordance with certain values. The special importance for intercultural ethic competences have values of freedom, equality and solidarity. These values imply both self – esteem, but also the selves of others, the capability of listening to the others, recognition (identification) and the like. These competences suppose conscience and acceptance of differences and diversities.

3. **Social competences** – they have its complete expression in the context of every day personal and social life. They enlighten and strengthen the individual's need to live with

other people, to cooperate with them, accept responsibility, delegate rights and commitments.(Kostović, 2008)

IV. TEACHER'S PERSONALITY AND KEY COMPETENCES IN INTERCULTURAL CONDITIONS

A teacher is a person designated for teaching profession, authorized and responsible to realize the objectives of education and upbringing, tasks and contents regulated by law.(www.zavod.edu.rs).

One has to cite the position according to which "the profession or occupation of a pedagogue by its nature is very complex, but always based on optimism, settled belief in values and in appropriateness of developmental – pedagogical activity" (Knežević-Florić, 2008:5).

There is no teaching good „just by itself". It is necessary to answer four questions (www.sajt.com.hr):

1. For whom the teaching should be good? The criteria of worthiness ought to be valid for all pupils attending comprehensive (general education) and vocational schools, consequently, for girls and boys, for higly talented and gifted, for those who learn quickly and for those who learn slowly, for hyper – active pupils and for quiet children praised because of their sweetness.

2. Which subjects need criteria for valuation? The criteria of worthiness in principle need to be valid for all school subjects, for all school grades (degrees) and for all kinds of school. Some additional criteria for certain subjects, grades and kinds of school need to be introduced.

3. For which objectives need they be valid? Those criteria ought to help to realize teaching and thus will be advanced cognitive, emotional and social learning of pupils.

4. What are these criteria for, i.e. what is their function in quality acquiring? They are of use in analyses and valuation of every day teaching. They can be used for individual reflection about good and bad characteristics of one's teaching. They can also serve in common valuation processes in teaching – pedagogical board, at workshops or at faculties (universities). They are not suitable in research purposes, because too non – operationalized elements are in them.

Successfulness of realization of intercultural education at schools depends very much on teachers' knowledge and cleverness. **Banks distinguishes four key kinds of teachers' competences:**

1. **Knowledge of pupils' characteristics –** Teacher ought to know specific learning style of every pupils and to sdapt his teaching style to each (one) of them. The researches show that the greater similarity between teaching style and pupil's learning style is, the greater will be pupil's attainment. Pupils ought to be given the possibilities that suit them.

2. **Detail and flexible knowledge of subjects and contents** – in order to be able to instill knowledge into all pupils, teachers ought to understand in which way are various contents connected within one subject linked with the other subjects contents, as well with pupil's every day life. A teacher ought to be able to design his lessons in the way which will enable every pupil to form a coherent and applicable "map of knowledge", and to connect different ideas as well to catch sight of illogicalities and errors.

3. **Cleverness of class managing** – A teacher ought to induce and maintain:

- Collaboration among pupils during the learning process (contents managing);
- Positive and responsible pupils' behavior using assertive communication, arrangement of essential rules, introduction of rewarding system and the like (behaviour managing);
- Various cultural patterns of group behaviour peculiar for school and surroundings in which reside pupils (managing class as a social system).

4. **Awareness of the ethics of one's own profession (pedagogy)** – Teacher ought to be able to reexamine the existing school practice and concept of knowledge learning on which that practice exists. In addition he proposes and introduces innovations for advancing both school and education (www.most.org.rs).

Teachers who have successfully included intercultural dimension in their teaching and work with pupils can be recognized according to these characteristics:

1. They know to pronounce absolutely correctly name and surname of every schoolboy or a school girl;

2. They comprehend how teachers' values, attitudes and expectations act on pupils' motivation for learning and attainments;
3. They are on the look – out for values, attitudes and opinions of parents or guardians on various aspects of pedagogical – educational work, and appreciate them;
4. They examine and get to know differences in learning atyles, i.e. prevailing styles of learning with pupils of different social and cultural origin;
5. They believe that, when right access to teaching materal and pupils is chosen, everybody can learn the most complicated curriculum. They concert their efforts that every pupil's attainment would be best and highly valued. (www.most.org.rs).

V. CONCLUSION

Consequently, intercultural upbringing and education is an unavoidable factor in the process of mutual acquaintance and understanding of various culturaes, as well as the way of establishing positive relations. It is also the result of need to arrange multicultural societies according to the principles of cultural pluralism (mutual comprehension, tolerance and dialogue, experiencies and permeating proper, one's own and dissimilar cultural features), universality (common interests, convictions and modes of life) and social dialogue (cultural special qualities and common elements).

In multicultural surroundings a new part has also a teacher, which is not only a good connoisseur of other cultures, "floodgate" against arising of stereotypes, lopsided attitudes and preconceptions, but an associate – creator of new relations according to real knowledge and successful intercultural relations.

Teachers are claimed to possess intercultural competence as well whole – life learning, connoisseurship of the international and transnational relations, as well to respect and accept the pupils who belong to other cultural identities. Teachers ought to be in interactive relations with the others. They are plain – spoken and communicative, creative and flexibile as well without prejudices and cliches.

Cultural diversity in school includes implicitly repeated meeting of disciples and teachers of various cultures as immigrants and ethnic minorities, that possess certain cultural models and pedagogical strategies, as well social, economical, historical and cultural characteristics.

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CONTRIBUTION OF INFORMATION TECHNOLOGY IN IMPROVING OF THE EDUCATIONAL PROCESS

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Abstract – As new information tool, the computer is used to give students a valid, reliable and relevant information needed for their work and learning. Initially, it related primarily to the subject of Informatics and Computing and later it started to get other attributes, i.e. it has become a tool for learning and other subjects and disciplines. Information technologies have made great contribution to the development of different forms of education in both formal and informal sense. This paper wants to study in order to determine whether education is still slowly opens up to new technologies in relation to other activities. In conclusion, the paper gives an opinion of young people at home and out of school who live in a technologically rich environment, do they expect changes in education in accordance with the imperatives of education in the 21st century. In this sense they provide assessment of the dynamics and form the introduction of multimedia systems, distance learning, virtual schools and other technologies that lead to an increase in activities of students, qualitative evaluation of knowledge and progress of pupils according to their individual abilities and prior knowledge.

I. INTRODUCTION

Education is an important part of living and working segments of each man. Knowledge of each individual in a special way is also its capital, its investment in himself/herself that will result in success. Each generation always believed to participate in change and creating a new one. However, no changes were so fast and present in all areas of human activity such as these recent ones. Operations performed with the knowledge that was long ago collected or used to be taught, are more and more rare. Each individual must work independently on himself, and to educate through various forms of informal education.

Viewed today, education in the information-time, does not depend on and can not depend on the will of a person or a small number of people who would have the task of deciding, but it achieves and plans through actions of numerous participants, teachers, students, parents, employers and the state as a whole. Hence, it is urgent to develop a plan, so instructional materials for students can be formed in a pedagogical, methodological format, which will students and the older generation train for the present and the future based on informational-communication technology.

With utilization of information technology many authors noticed the need to process educational content from all other subjects, ie. other scientific disciplines with the help of computers and their resources. Based on the experiences of educational systems in other world countries we started with the innovation of educational technology, complement the teaching methods with students. With the help of professionally processed content, images, video and audio, students are offered with more interesting, obvious and rational presentation of material, which is part of education. In development of this idea the most helpful was Internet which teachers students and experts used to present their work and tasks in order to help other in studying or to get answers on some specific questions.

Education Technology and *Instructional technology* are often used terms in argues about the education. Education technology seems as a common need of technology in education, and Instructional technology is a direct implementation of technology in stydy process so it makes a subset of Education technology. The structure of educational technology contains two components:

The first component contains different teaching materials and teaching aids (computers, projectors, digital cameras etc.), while the second

component is related to various processes that accompany education. Many authors (Kosakowski, 1988.; Schacter, 1999.; Wilmot, Jasen, 2001.; Jenson, Brayson, 2002.) argue that integration of contemporary technologies in study process and teaching presents:

- introduction of modern information technologies,
- introduction of multiple variable context and educational applications of information technology,
- testing of new models and approaches to learning, teaching in the context of the application of information technology.

Thus, the pupil today during its school time gets information from school, the actual environment in which it lives (people around it, nature, TV, radio ...) and from the so-called. virtual environment posed by the Internet and Web environment. Today the Web offers a rich educational content in various languages.

Picture 1. Studying a foreign language using modern technology

New Media as well as the Internet requires new skills and new knowledge, and only when an individual master these new skills he can use these media online. Educational portals serve as a special computer tools that were created from the need of individuals and communities for development and efficient use of the information hyperspace of learning on the Internet. In this paper we talk about the conditions of their existence, purpose, concept and possibilities of use in practice, and beyond.

II. THEORETICAL BACKGROUND ON THE USE OF INFORMATION TECHNOLOGIES IN TEACHING

Information technologies are new technologies that have become an integral part of many human activities and have implications in

Education from preschool to higher education institutions. Technical and technological progress in the economy, after the proven productivity, reflects in teaching and therefore it is inevitably changing. Unfortunately, these changes in educational institutions are long overdue, because of the power of inertia effects at all levels of education. However, in the slow pace of the teaching process is getting modernized, as training of personnel in strategic educational activities, as well as the use of media and multimedia, where technically more modern teaching materials and teaching aids pushed out of date. If the school is equipped with the latest, media, IT and multimedia, this still does not guarantee its functional use in the system of teaching. Functional use of information resources, media and multimedia in teaching involves flow of new information that students will be able to use in their lives: " Now it is dangerous to give children the old information because they will not help them to live in the future, it will only hinder their growth. Now they need the intelligence to live with rapid change - it is happening now." (Osho, 2007:182) Teaching worker should create conditions for the development of students' actual and potential capabilities and its needs.

It is no longer enough to lifelong training of teaching staff in the didactic-methodical and technical-technological area: how, when, why and with whom to use teaching materials and new teaching technology. For these reasons we focus research on implicit progressivist (constructivist) pedagogy that, in contrast to traditionalism, emphasizes the importance of transactions in teaching and creating their own knowledge construction by students who do not adopt it a mechanically, but through its use in similar or different situations. That's why we believe that the epistemological views of teaching staff are key determinant in the design and implementation of teaching, but also in students' achievement.

III. INFORMATION TECHNOLOGIES AND NEW FORMS OF LEARNING

In this paper we want to draw attention to the implementation of new forms of education that enable implementation of information technology. On this occasion we will pursue the e-education and what are its benefits and explain some important concepts, development of distance education, what is life long learning and European programs that deal with it. E-learning is the performance of the educational process with the help of IT technology. This educational

process is teaching at a distance in which the teacher and students are not physically at the same place, such as distance instruction via video conference system, which is transmitted to remote locations or online item made in the tool for distance education. E-learning can be called as an enrichment of classroom instruction, for example, visualization of a topic by using the projector, computer and projection screen. E-learning means using electronic applications in the learning process (*computer based training, web based training, virtual classrooms, digital collaboration*)

- **Computer Based Training** (CBT) is the application or application set with which you can deliver content for education through computers. It includes lessons, exercises, simulations and testing.
- **Web Based Training** (WBT) is the application or application set with which you can deliver educational content through the web browser Internet. **Virtual Classroom** is an online headquarters where instructors and students can communicate synchronously.

Benefits of E-education

- opportunities to participate in teaching at any time and from anywhere,
- individual approach of students and acceptance of different learning styles,
- better interactivity of speakers and listeners,
- higher quality of teaching and increased possibilities of material adoption, which include encouraging listeners to analytical thinking, sintetization of acquired knowledge and independently solving problems and decision making,
- inclusion of different profiles of students (employees, people with families, students from inaccessible areas, people with mobility problems, etc.),
- easier training and retraining - providing new opportunities for lifelong learning,
- simpler organization of lectures by international experts via video conference transmission;
- decreased need for mobility of teachers and students.

Lifelong learning is defined as the activity of learning throughout life to enhance the knowledge, skills and competencies within personal, civic, social and business perspective.

The idea of lifelong learning appeared in Plato's work »Republic«, but it was first fully articulated by Basil Yeaxlee (1883-1967), in cooperation with Eduard Lindemann (1885-1953) professor of Social work who was focused on adult education and who gave the intellectual foundation for understanding education as an ongoing aspect of everyday life. This was used for a discussion of variety of European traditions such as the French notion of education as a permanent and based on monitoring the development of adult education in Britain and North America.

Lifelong learning involves:

- The acquisition and modernization of all types of abilities, interests, knowledge and skills from preschool to retirement,
- The concept of developing knowledge and skills that will enable citizens to adapt the knowledge about society and active participation in all spheres of social and economic life and thus affect on their future.
- Respect for all forms of learning: formal education (eg. high school, college), informal education (eg. improving the skills needed in the workplace), and informal education, intergenerational learning (knowledge sharing in the family, among friends, etc..).

Among International programs dealing with lifelong learning programs we emphasize Leonardo Da Vinci program developed from the need to prepare Europeans for entering on the labor market in order to decrease unemployment. The companies have a need for trained workforce that can compete with the addition of rapid scientific and technological changes. In order to overcome these problems, the European Commission has developed a Leonardo Da Vinci program, which functions as an innovative laboratory in the field of lifelong learning. During the period 1995-1999 there was a realization of program of education and training for specific occupations.

The main objective of the Leonardo Da Vinci program is to help people to advance their skills throughout life.

Socrates program is also an European program for education which included around 30

European countries. Its main objective is to build a Europe of knowledge and thus give a better response to major changes in this century. It seeks to promote lifelong learning, encourage access to education for all and help people acquire the required qualifications and skills. Socrates program encourages mobility (moving through Europe) and innovations. Socrates program includes eight actions:

- Comenius – education at schools
- Erasmus – high education
- Grundtvig – education of adults
- Lingua – teaching and learning of European languages
- Minerva- informational and communication technologies in education
- Observation and innovation – educational system and politics.

Bearing in mind the data moving in the European conception of education, this paper wants to study in order to determine first of all developments in our understanding of this education, if education is still slowly opens up to new technologies in relation to other activities. The paper gives wants to hear the opinions of young people at home and out of school live in a technologically rich environment, do they expect changes in education in accordance with the imperatives of education for the 21st century. This work still wants to hear the opinions of young people who at home and out of school live in a technologically rich environment, do they expect changes in education in accordance with the imperatives of education for the 21st century

IV. RESEARCH ORGANIZATION

If a school is imagined as a resource for students, consider teaching as a 3D space, and the broader environment (natural and cultural) as a fourth dimension, then the virtual reality is a fifth dimension which goes through all other dimensions.

The school can ignore the existence and importance of environment and virtual reality, but it leads to reducing and limiting their educational and educational role and it can be confirmed as a closed system. The presence of school and all its components in the fourth and fifth dimension, make it more open, more modern and more relevant to practical life. In order to crate opportunity for schools in Serbia to introduce students with the fifth dimension of the school, it was necessary to equip them with computer equipment and teaching staff to introduce the information age. To show to what extent is all this present in our study, we tried a sample of 257 primary school students aged sixth and seventh grades, in the territory of Kolubara County. The research was conducted in schools in following towns: Valjevo, Lajkovac, Osečina, Mionica, Ub and Ljig. Second sample for this study were 24 teacher-implementers of informatics in elementary school. Data collection was made with survey sheet, whose completion was independent, voluntary and anonymous. Choosing schools for the questionnaire filling was based on a random basis, at the same time taking into account the proportional representation of schools in all municipalities on the territory of Kolubara County.

Basic characteristic of the sample of students is reflected in the uniformity of pupils in classes, the distribution of respondents in all districts. Representation of students per grades is 125 pupils from sixth grade or 48,7% and 132 pupils from seventh grade or 51,3% of total sample.

As for the sample of teachers who implemented the teaching of informatics in elementary school, there is also an equal representation in schools and municipalities. The sample is random and consists of 24 teachers.The sample for this study is significant given that these teachers are the main carriers of the application of ICT-Informational-communication technology in school. A number of them are responsible for the implementation of all activities at the school for the necessary use of information technology. In some schools, they are included in the implementation of certain educational lectures and assist other teachers interested in the decentralization of some content from their subjects. *The subject* of work is to investigate the role and efficiency of IT in education of students in elementary school. *Purpose* - The study aims to determine the level of presence and representation of ICT in teaching elementary school, the ratio of teachers familiar with IT in teaching and the level of material investments and management desire for innovation. *Duties* of investigation are focused on following questions: To what extent and how efficient is the use of Information Technology in the implementation of educational content in all teaching cases? Does the use of IT for the realization of educational content helps students to clarify the problem, how it helps them to learn more easily and efficiently?

Research hipothesis is the scientific assumption that scientific research must confirm

Yes, I have my own computer	189	73,50%
Yes, we all use it in the house	27	10,50%
No, I use the other	41	15,9%
Do you have Internet?	219	85,5%
No, I don't have Internet	23	8,9%

or not. In our case we set the hypothesis that states:

In primary schools, in teaching computer science and in teaching other subjects, applying scientific and technological development is not monitored sufficiently, so teaching in primary schools is not likely to any time soon become more efficient and innovative.

Up to 5 subjects	123	47%
Up to 7 subjects	33	12,8%
Up to 9 subjects	21	8,7%
Over 10 subjects	11	4,7%
Less than 5 subjects	70	27%

In the main hypothesis there are subtheses:

1. The content of teaching in education does not sufficiently monitor current techniques and techn ology

2.Most students do not yet use ICT achievements.

3.Teachers are still reluctant to embrace the achievements of information technology, and few teachers integrate their teaching in IT.

V. RESEARCH RESULTS

The computer should be considered a teaching tool, and during the teaching it should be used when you can create a new specific teaching situation and offer new and useful approach to learning and teaching. Information technology-assisted education includes at least three basic components:

1) Computer Assisted Learning – CAL
2) Computer Assisted Research
3) Distance Learning - DL

We were interested in investigating the first component. Computer-aided learning is most often used and it is very suitable for the realization of interaction between students and computers to improve the existing technology of learning, teaching made more evident, more dynamic and interesting with the involvement of more students' senses in acquiring new knowledge. Computer-supported learning includes multimedia educational software, computer simulation, virtual reality, artificial intelligence and others. Using information technology provides the individual learning, constant feedback and monitoring progress of students as the teacher helps to realistically evaluate the knowledge of students and instructs them to other teaching media in order to successfully master the new knowledge. In this study, students are helped with their answers to find out how truly computer supported learning is (*Computer Assisted Learning – CAL).*

First question: Do you have a home computer and Internet?

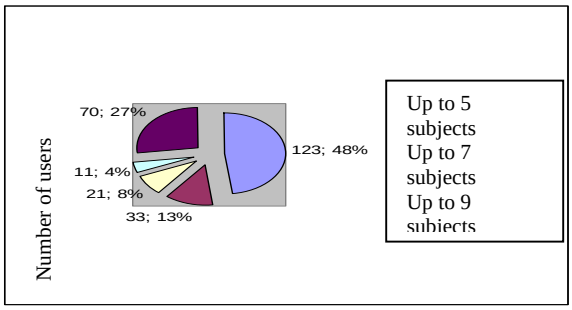
TABLE I. OWNING A COMPUTER

We see that there are still a number of families thus students who do not have computers at home -15,9%. These are the consequences of economic developments in the world, and in our country.

Another question that students should answer was: How many subjects in class include teaching using the computer?

TABLE II USING COMPUTERS IN CLASSES

According this table we see that there is a very small percentage of subjects in schools where teaching is carried out with the help of computers. This shows that there is a very little use of other information technology , projectors, slides and presentation of certain content that students were more obvious and more interesting.



Graph 1.. The percentage of computer usage during teaching

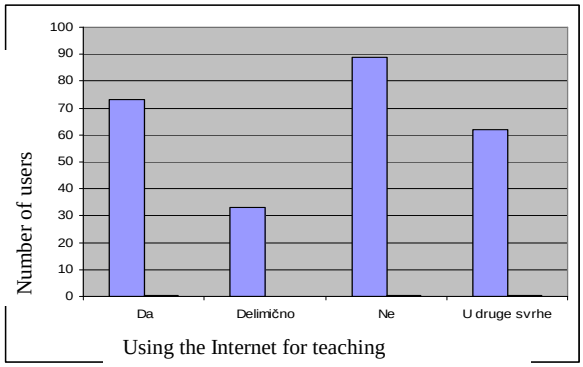
The third question was aimed to determine how students use the Internet to supplement knowledge and make new content:

TABLE III.USING THE INTERNET FOR TEACHING

Yes	73	28,5%
Partially	33	12,9%
No	89	34,7%
Other purposes	62	24,1%

According to table 3 and graph 2 we can see that there is more examinees 34,7% who don't use Internet for teaching than thos who use it 28,5%. Specially important is to notice that 24%

examinees use Internet for other purposes instead for school and teaching.



Graph 2. Using the Internet for teaching

How did you learn to use computer and Internet?

Using this issue we wanted to gain insight into how learning computer prevails among the students, and if that later played a role in a greater or lesser use of computers for teaching.From the results (table 4.) it is clear that there are students who still gain self-knowledge, and respond immediately followed by "with the help of a friend" at school

TABLE IV METHOD OF INFORMATION ACQUIRING KNOWLEDGE

Independently, with the help of literature	48	18,6%
At school	128	49,8%
With the help of friends	58	22,5%
Independently, with the help of literature	33	12,8%

Displayed results lead us to think about innovating the curriculum with more opportunities for using information technologies and their resources.

Research conducted by teachers was aimed to cover a population of teachers employed in primary schools in that territory, and evaluate the use of information communication technologies in the preparation of the teaching process, and in its performance. The questionnaire, which teachers have completed given the following indicators.

How many computers are used for the preparation classes, and how much during lessons? The data show that the computer is much more widely used in the preparation classes than during lessons (table5) This can be attributed to the equipment of schools with computers, not only in the computer classroom, but also in the classrooms with other subjects which could be implemented with the help of computer classes, but schools are still lacking with that equipment.

TABLE V COMPARATIVE REVIEW OF THE USE OF COMPUTERS TO TEACHING PREPARATION

Always		Often		Occasionally		Never		No answer
P	N	P	N	P	N	P	N	
11	7	6	3	3	2	4	12	

This study also contains the issue of whether teachers have a computer at home, or have the computer which "is" in school. Equipping teachers with computers and their use in private life is certainly in direct proportion with the use of computers in teaching (if the computer is becoming a daily tool, it is certainly more and more used in the teaching process). The fact that teachers really have the awareness of the need for computers in modern life, shows that 83% of them has a computer at home, while the average in the Republic of Serbia for the year 2008 is 40.8%.Regarding software packages that are commonly used, it is obviously that the most used software are those for word processing, and it can be concluded that the computer is still regarded as little more than a typewriter.

Do you follow the news in the field of computer applications in education? The possible answers were "yes" or "no." The results indicate that new developments in the field of application of computers in education are followed by 62.22% examinees, while 38.57% of examinees doesn't follow it.

VI. CONCLUSION

The future is in the computerization of school instruction. in our region it is achieving rather slowly, so that our generations go to workplaces and that are not sufficiently trained for the new challenges that carries the information society. Such a situation is influenced by many factors that can be viewed through two aspects:

First one is technological and there we think that in the future schools can accept new technologies which can provide utilized learning, Prvo tehnološki i tu smatramo da u budućnosti škole apsolutno moraju prihvatiti nove tehnologije koje omogućavaju olakšano učenje, distance learning, searching encyclopedic knowledge base, and improving communication student-student, student-teacher and teacher-teacher with the latest networking and internet technologies. Numerous studies have shown that learning through a variety of multimedia (text, picture, sound) contents encourages greater

interest and enhances the concentration of students in general. Without linking educational institutions with modern communication technology it will not be possible to follow the development trend of science and slowly everything will fall further behind in scientific thought in the world.

Another aspect is pedagogically-sociological. As well as technology brings many benefits, we must pay and great caution in order to implement this technology in education. We should not allow the computerization of education into a mere monitoring of trends and latest fashion accessories in the world of computers and information technology in general. It won't have any connection with education. There is a need for a strategic plan and program for introduction of information technologies in education and science, for only in this way we can achieve the primary goal: improving education with the help of computers.

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FOREIGN LANGUAGE LEARNING WITHIN *HOOK UP!* PROJECT

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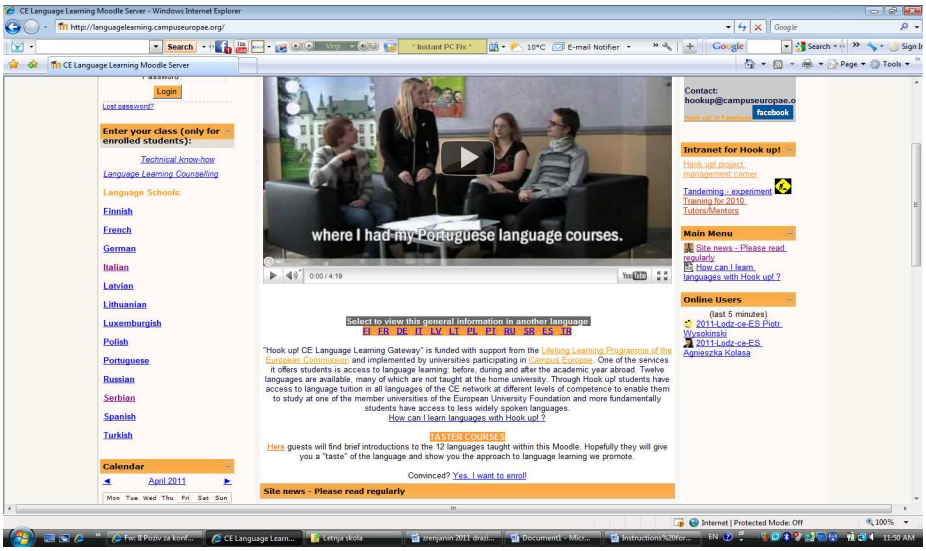
Abstract – The paper gives a short description of the Campus European project, one of the international projects of the Council of Europe. The emphasis is on the segment of the project which is related to distance foreign language learning. In the context of student mobility and study visits, this project promotes the idea of language learning at a foreign university. The Hook up! platform based on the Moodle platform offers a student the opportunity of online language learning before their arrival in a country where they will spend their mobility year. The paper presents course designing facilities provided by this platform.

I. INTRODUCTION

One of the basic ideas within the Campus Europe project, which enables students from Europe to spend a part of their studying period in one of European countries, is to promote the language of the host country. This idea resulted in the creation of *Hook up! CE Language Learning Gateway* (http://languagelearning.campuseuropae.org), the project within Campus Europe. Hook up! is set up with the support of Lifelong Learning Programme of the European Commission used by the universities that participate in the Campus Europae programme (http://www.campuseuropae.org/en/).

With time, there appeared the idea of creating online courses for all languages in the network of this project, which would be taken by students before their study period abroad so that they would be ready to take on a higher level intensive course (at least A2) in September on arrival at the host institution. Thus, after completing these two courses (online and intensive) and passing A2 level exam, a student without any prior knowledge of the language that they are supposed to learn (i.e. an absolute beginner), can integrate into the courses of the host university in October. Furthermore, during an academic year, students are obliged to attend the language course and, at the end of the year, reach B1 level of knowledge according to the Common European Framework of Reference for Languages.

Hook up! provides students with the opportunity to learn one (or several) of twelve languages belonging to the network of CE universities. The plan is to design online courses for every language from A1 to B2 levels of knowledge with the purpose of enabling students to study at one of the universities that are the members of the European University Foundation.



II. PROJECT CONCEPTION

Designing of all online courses is based on the Moodle platform. [1]

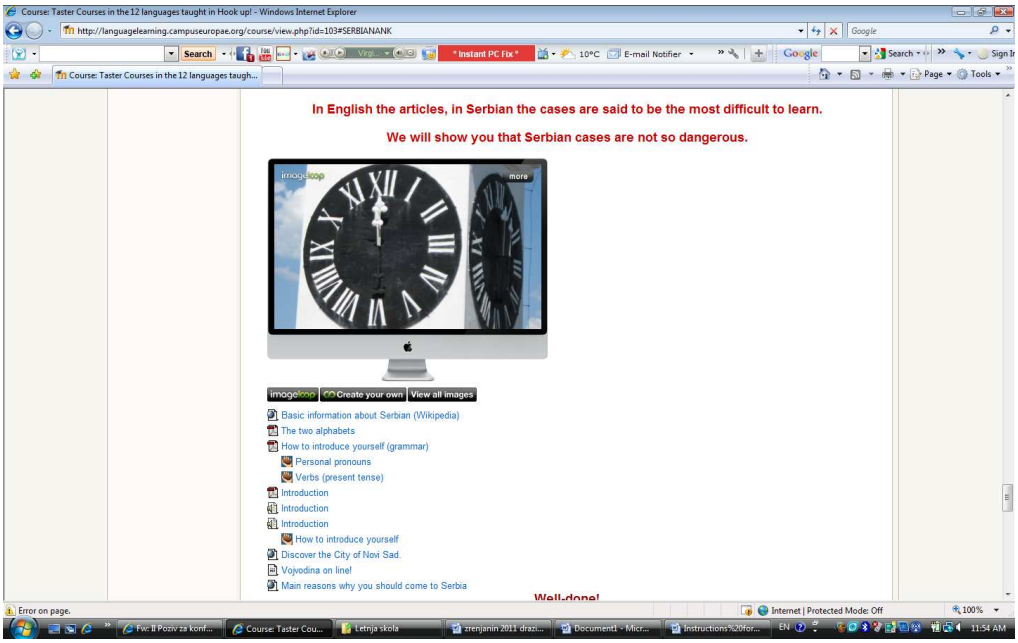
Moodle provides a user and/or language instructor with the following facilities:

- loading of necessary materials during the creation of online courses (texts, links, grammar explanations, comments, tasks, tracks, video material, etc.);
- activation and use of forums and chat sessions as a way of communication beyond an interactive online lesson. On one hand, the forums provide students with the opportunity to ask questions related to the course, comment on the lesson, etc at a temporal distance since the communication is not simultaneous and it allows enough time for both asking and answering the questions. Every sent message is automatically forwarded by e-mail to all students including the instructor. The chat sessions, on the other hand, provide students with the opportunity to simultaneously communicate (only with the instructor or together with other students within a conference);
- creation of an online quiz, i.e. a test on the basis of which it is possible to (1) determine the level of knowledge of students with certain prior knowledge (placement test), and (2) monitor students' advancement;
- creation, realization and assessment of writing tasks
- monitoring learning advancement of each registered student – at any time the instructor can check students' activities, marks, course attendance, regularity of homework [1].

In addition to the basic information on the project itself, application forms and online courses for twelve languages, Hook up! provides (1) the so called tester courses for each offered language, (2) Language Learning Counseling, (3) site news as well as (4) online training for instructors.

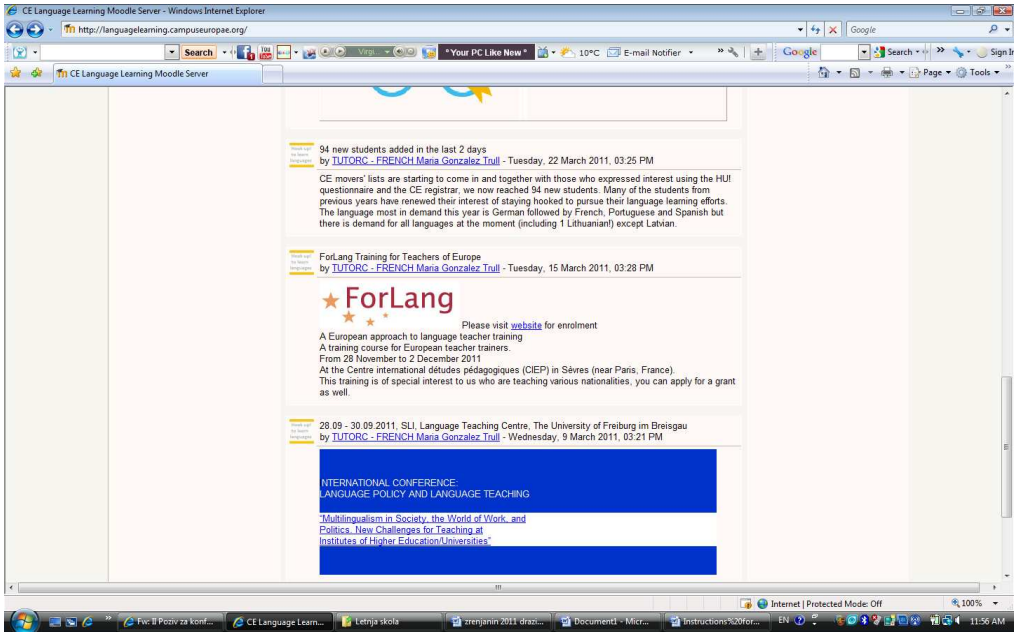
(1) **Tester courses** are short courses for all offered languages that are realized independently. Their aim is to motivate students as well as to promote a host country and its language. Every tester course contains the basic information on the country, region and/or city of the host university, interesting links and several exercises at the beginner level of language learning so that students can gain a general picture of the language, country and city that they will visit.

[1] Moodle - *Modular Object-Oriented Dynamic Learning Environment* (COLE AND FOSTER 2007) is free software that provides the facilities for creating various systems used by universities, various organizations and institutions as well as individual instructors in different areas to enrich and refresh their courses with multimedia tools and technological innovations.



(2) **Language Learning Counseling** began as the result of students' need to answer various questions and solve problems related to language learning (opportunities, advantages, motivation, etc), which they could encounter during their stay in a foreign country.

(3) On the home page of the Hook up! Platform, there is a regular news update on the number of students, course attenders, world conferences on foreign language learning or distance language learning, dissemination activities, etc.



(4) **Training for instructors** was organized during the online courses. Interactive conferences and meetings on a particular topic (chat sessions, video conferences, etc) were organized once a week so that instructors could share information and experience.

III. CONCLUSION

It can be concluded that Hook up! provides students with the opportunity to learn one of twelve given languages as well as to meet students from other countries, who are involved in the same learning process at the host

university. Furthermore, students acquire the skills in the area of information and communication technologies (ICT) that improve their learning habits, make them independent and prepare them for active participation in "knowledge society".

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THE APPLICATION OF INTERACTIVE WHITEBOARDS IN PRIMARY SCHOOLS OF VOJVODINA

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Abstract - The structure of the information society, the growing of "net-generation's" visualization, the way of production and acquisition of information, as well as the dominant pedagogical principles of nowadays (interactive education) make it important to include such an interactive tool in the process of education, which fits these principles and is connected to the virtual space via the Internet. The appropriate technological background, decreasing prices and simplification of equipment, together with the direction of educational goals have opened the door to the use of interactive whiteboards in schools by the millennium. This paper gives a situation analysis of primary schools in Vojvodina, pointing out the deficiencies, opportunities and advantages of using interactive whiteboards.

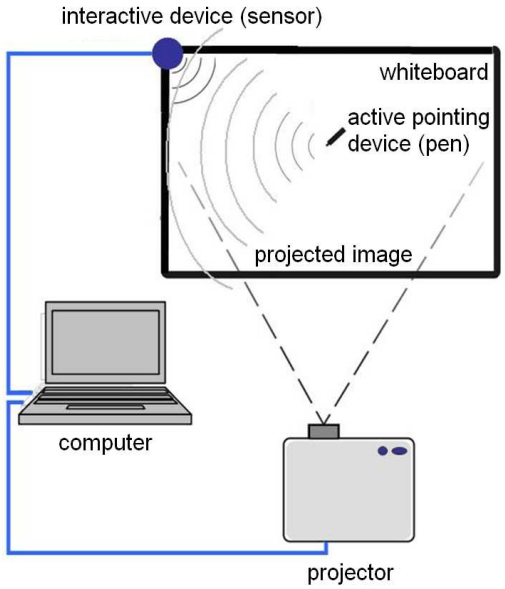
I. INTRODUCTION

Looking back at the history of schools and education, it can be stated that the latest technical achievements have inevitably (although with some delay) entered the education process. Examining the background of this phenomenon, it becomes clear that it has happened for two reasons: 1. It was important for students to get familiarised with the use of certain pieces of equipment, to prepare them for carrying out work processes that require such devices; 2. In order to improve the quality of school classes, resulting in more motivated participants and more effective knowledge transfer.

When talking about the education of younger generations, we have to remark that the use of these devices has to appear in an integrated way, primarily based on games and basic skills (digital ink and pointing devices).

II. APPEARANCE OF INTERACTIVE WHITEBOARDS

The interactive whiteboard is located at the end of the evolution process of education technology leading from chalk and traditional blackboards, over felt-tip pens and whiteboards, then computers, projectors and whiteboards, to computers, pens, projectors and whiteboards (or touch-sensitive surfaces). It is an educational tool that consists of a computer, a projector, an interactive board and the cables connecting them.



Picture 1. Working principle of an interactive whiteboard

If we compare this system with the previous development stage (computer, projector and whiteboard), we can see that the advantage of the interactive whiteboard is in its interactivity. This interactivity could be achieved only in a restricted way at the previous stage, coming near to the computer. While here we have complete interactivity since this device does not ties the user to the computer. Standing in front of an image projected to a touch-sensitive surface we can teach interactively. We can initialise various mouse functions (left click, right click, double click) using a pen or touching the surface. Moreover, with the help of the interactive keyboard and the handwriting recognition system we can input even handwritten texts to the

whiteboard without leaving it or losing eye contact with the audience, and not interrupting the natural flow of the class.

Interactive whiteboards first appeared in the field of business at the end of the '80s and the beginning of the '90s, used for in-house trainings and presentations in certain companies. The especially high price of that time has decreased by the beginning of the 2000's making this device available for educational institutions as well. This meant the beginning of their use in schools. Beside the price the other obstacles for spreading of this device were the lack of ready contents presentable on these boards and the lack of necessary knowledge. The intensified and centralised utilisation of interactive whiteboards in the field of education began in 2002, first in England, Scotland, New Zealand, Canada and the United States of America.

III. CLASSIFICATION OF INTERACTIVE WHITEBOARDS

There are several classifications of interactive whiteboards, while the most frequently used one is the following:

- Hard boards: Their feature is that we make a suitable surface (mostly a whiteboard) interactive. For the operation of such a system it is necessary to have a suitable projection surface and a pointing device (pen) as well, beside the computer, the whiteboard and the projector. The advantages of these types are that they are easily movable (being fixed to the board with suction-grip discs), their prices are generally more favourable, but they require a special pointing device, which operates with batteries.

Picture 2. mimio Xi, one of the most popular hard boards

- Soft boards: Their feature is that they project the image to a board placed usually on a stand (or built into the wall). This surface is touch-sensitive since numerous micro controllers are mounted on it. As a result there is no need for special pens to use these boards, since this technology senses the touch of our finger, a plastic pen or any other object. We can mention as disadvantages that their price is higher and their movement is more complicated.

Picture 3. Smart SB640, one of the most popular soft boards

IV. OPTIONAL ACCESSORIES OF INTERACTIVE WHITEBOARDS

Producers of interactive whiteboards offer various accessories, some of which are useful, while some are less inevitable or can be only partially utilised by a teacher working in a traditional class. Beside the standard equipment we can choose from the following optional accessories of interactive whiteboards:

- Voting and response system: Feedback from students and the students' knowledge level are the best and most reliable measures of the effectiveness of teachers' work. Within the traditional teaching model this feedback is often delayed, occurring usually over certain forms of assessment. Using voting and response systems teachers can get immediate feedback from students about how well they have learnt the subject-matter, and may ask their opinion. They can view the results on the interactive whiteboard (as a chart) after the voting, thus achieving reliable information about the successfulness of learning. This way, teachers get a true picture

of the outcome of their work at individual level. These responses highlight the deficiencies and the teaching methods that need to be improved.

- Sketching boards enable students to draw on the projected image, write comments and display explanations. Furthermore, they provide mobility to teachers since they can write on the projected surface from any part of the classroom. This device can be excellently utilised in the education of disabled people.
- Ultra-short throw projector is a special type of projector that unlike the traditional ones projects the image to the surface from a very small distance. Its advantage is that the light of the projector does not irritate the teacher. The same problem can be eliminated with the use of boards mounted on the wall and projected from the back. High prices hinder the spreading of both types, so the existing projectors are usually used for projecting on the sensitive surface of the interactive whiteboard.
- Wireless connection: cables are usually annoying (they are not long enough, teachers may stumble over them). These problems are resolved with the use of wireless connections based on the widely utilised bluetooth technology.

Picture 4. ECDL training where hospitalised students could join via the Internet (Mali Iđoš, 2010). Hardware: computer, mimio Xi, projector, web camera, bluetooth headset. Software: Windows XP, Skype, Excel, mimio Notebook, mimio Tools.

V. POTENTIAL USE OF INTERACTIVE WHITEBOARDS IN EDUCATION

Interactive whiteboards enable the realisation of virtual, multimedia and interactive classes led from a board. Every application that is running on the computer may be loaded and applied on an interactive whiteboard. We can classify the forms of use of interactive whiteboards the following way:

- The interactive whiteboard can be used instead of a traditional whiteboard. We can write on its surface using various tools (felt-tip pen, ballpoint pen, highlighter). This form of use in not only advantageous because we do not need chalk or felt-tip pen, but because it is easy to erase, the image on the board can be saved, printed or forwarded after a few clicks (it can be reloaded at any time). Beside still pictures we can also make motion pictures (videos) about the whole process. Furthermore, we can transform the projected image into a surface with squares, lines or staves for writing musical notations or even to a merils or chess board at any time.
- The use of an interactive whiteboard may be very useful during the presentation of various types of software (operating systems, word processing, spreadsheets etc.), since it enables the projection of not only static images but also entire processes (developing menus and submenus, operations with dialogue windows, dragging various contents etc.). It is very important that the teacher can freeze certain phases of a process and give further explanation. Browsing the Internet on the board may also be very expressive, the points of activity (clicks) can be followed and the explanations of certain parts are also more effective grounded on a big, projected image.
- The interactive whiteboard can be used for presenting previously prepared materials. These can be ready software or supplementary materials made by the teacher. Supplementary educational materials made using whiteboard software (mimio Notebook, SMART Notebook) provide the highest level of interactivity, and with the use of various integrated components (gallery, exercise editor, multimedia, experiments) teachers may get the best use of interactive whiteboards.

Numerous surveys have proven that the use of interactive whiteboards result in more effective knowledge transfer and more motivated students. In addition, teachers also get motivated after a successful class that has achieved its goal and the students have learnt effectively and with pleasure. Although the preparations require careful planning and are time-consuming (and

not lastly knowledge demanding), their hard work pays off multiple times, since a properly structured interactive curriculum is fascinating, can be used more times and is easily modifiable.

The use of interactive whiteboards can be incorporated to any of school activities, from certain types of frontal work (as a whiteboard, for presenting multimedia and PowerPoint presentations), over group work (a group prepares a presentation on the computer and then presents it on the board) to individual work (students come out to the board one by one to perform some tasks: drawing, matching, filling in some fields, activating some interfaces), improving the quality of work in the classroom.

An interactive animation available on this link http://vault.smarttech.com/videos/classroomtour/index.html presents the potential use of interactive whiteboards and their accessories.

VI. INTERACTIVE WHITEBOARDS IN VOJVODINA

Although a considerable number of teachers from Vojvodina know the potentials and advantages of interactive whiteboards, schools are equipped at a very low level. The main reason for that is in the lack of money. The number of interactive whiteboards in schools not only falls behind an expected level, but also in comparison with surrounding countries, especially Hungary and Croatia (in Hungary according to the National Development Plan II 40 thousand classrooms out of 62 thousand have been equipped with an interactive whiteboard by 2010). Another huge problem is the lack of centralised funds that could be spent on such developments.

Apart from this fact we can see that those types of boards that are popular on the international market are also available in Serbia.

These are:

- Systems based on Wii control: connecting the Nintendo Wii control (that was originally developed for detecting 3D movements) to the computer, adding a projector and using an infrared pen we can create an interactive and sensitive surface. Even a teacher with adequate technical skills can compile this system (commonly the pens are home-made). The biggest advantage of this type is its price since it can be made for a fraction of the cost of an original interactive whiteboard. Its disadvantages are the difficult calibration (the synchronisation of the computer and the projected image – the system works perfectly only with two Wii controls), the lack of software support, the wide dead area in front of the projection surface (the teacher has to pay attention not to hide the light and beams of the two controls and the projector).

Picture 5. The Wii control and the infrared pen with the accessories

- The mimio company (seated in the United States) gives preference to the development of portable interactive whiteboards, which make the whiteboards in schools become interactive surfaces complemented with a projector and a computer. Their best-known product is the mimio Xi, which is 24 cm long when closed and weighs less than 0.5 kg. This way it is easily portable and moveable, its setting-up and calibration is easy, and has a medium price. The software provided (mimio Notebook and mimio Tools) fulfils the needs of an average user.
- SMART (seated in Canada, but since 2009 also producing such whiteboards in Vác, Hungary) is the pioneer of boards that can be placed on stands, mounted on the wall or built into the wall. They not only make whiteboards interactive, but also provide the projection surface with various accessories. Their products belong to the group of soft boards, their movement is difficult or almost impossible (types built into the wall), the prices are the highest from the three mentioned types, however the quality and software support of the devices are one of the best in the market. The software of the board (SMART Notebook), beside different tools, gives opportunity to prepare exercises fast and simply, and also provides interactive

games and experiments.

There are very few interactive whiteboard courses in Serbia. Usually dealers of the boards provide trainings and presentations before and after a board is sold. There is only one accredited training about interactive whiteboards in Serbia organised by the Hungarian teacher-training faculty from Subotica with the title: Training of practicing teachers on the use of interactive whiteboards.

VII. SURVEY ON THE PRESENCE OF INTERACTIVE WHITEBOARDS IN PRIMARY SCHOOLS OF VOJVODINA

After our theoretic and methodological discussion we deemed it worthy to survey the situation in primary schools concerning the number of interactive whiteboards and the most popular types.

Our survey involved those primary schools and their departments that operate in Vojvodina.

We have evaluated 88 primary schools from 22 municipalities. The number of schools by municipalities: Apatin (1 school), Ada (6 schools), Čoka (7 schools), Bela Crkva (2 schools), Odžaci (1 school), Kovin (1 school), Mali Iđoš (2 schools), Kula (1 school), Kanjiža (6 schools), Zrenjanin (3 schools), Kikinda (3 schools), Bečej (8 schools), Pančevo (1 school), Subotica (14 schools), Srbobran (1 school), Temerin (3 schools), Bačka Topola (8 schools), Novi Bečej (2 schools), Novi Kneževac (3 schools), Novi Sad (3 schools), Senta (7 schools), Sombor (5 schools).

From the 88 schools there are interactive whiteboards only in 6 (6.83%). There is a slightly better situtation in the municipality of Subotica where 4 of the 14 schools have interactive whiteboards (28.57%).

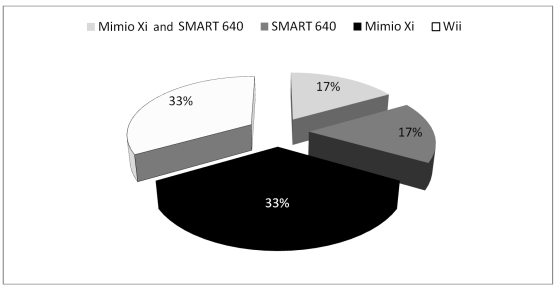


Chart 1. Appearance of certain board types in schools of Vojvodina (Námesztovszki, 2010.)

Analysing the types of interactive boards we have found that various types are present in these schools: Mimio Xi and SMART 64 (1 school), SMART 64 (1 school), Mimio Xi (2 schools), Wii (2 schools).

VIII. SUMMARY

We can state that the appearance of interactive whiteboards in primary schools of Vojvodina is at a very low level. Teachers are moderately familiar with the potentials and efficiency of interactive whiteboards, while those teachers who have already met these boards on trainings or in another schools make efforts so that their school can also get such a device as soon as possible. They mention the bad material situation of schools for being the biggest obstacle of purchasing these boards. According to them the utilisation of the boards would be intensive, firstly instead of traditional blackboards, but there would also be willingness for learning and preparing digital curriculum.

Of course, we also face some opposition. Those teachers who have lagged behind somewhere with the use of computer or the computer and projector, will surely be less motivated for using the interactive whiteboard and for digitalising their traditional (paper based) contents. We can achieve the use of interactive whiteboards among these teachers if we provide them ready and instantly integrated parts or entire contents. However, even then they may be reserved because of the fear from failure that can emerge from the phase of downloading the materials until the time of presentation. We have to know that these failures may be prevented with life long learning, invested time and energy (that pay off later), while technical problems constantly emerge at students, teachers and even IT teachers in every system controlled by a computer.

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MULTI-FRONTAL TEACHING WITH A MOODLE SYSTEM

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Abstract - The paper presents how Moodle-based multi-frontal teaching is organised in order to overcome traditional frameworks of teaching. Starting from the basic features of multi-frontal teaching (MFT), students' activities and the altered role of a teacher, and bearing in mind possibilities provided by the Moodle System, the students of the third and fourth year of grammar school are taught Logic and Philosophy. Due to the organisation of the contents which requires thorough preparation and professional competence on the side of the teacher, it is possible to have different approaches with regards to students and teachers. The teaching material in the electronic form is at disposal to be applied in MFT and can be used when organising E-learning.

I INTRODUCTION

Petar Savić (1910 – 1993), pedagogue and founder of MFT initially wanted to change the traditional roles of students and teachers, trying to individualise teaching and make a step out of the ordinary, traditional framework of teaching. The basic principles, which the author of the MFT model and his followers decided on, are also the particularities that make this concept stand out. According to Savić, Guteša D. (2001), the model of MFT is based on the following principles – the contents of the subject matter are processed in a new way – namely, the students study independently for the most part, using the literature and receiving teachers' assistance:

- Students have are under the obligation to present a review of the entire subject content that has been foreseen by the national curriculum for a particular subject during a particular school year.
- The teacher does not call out individual students for oral examination. Instead, they decide, what unit they will present and when.
- Before their presentation, they will say what mark they are ready for, and they will prove that they deserve it with the quality of their presentation.
- When they show that they have adopted the entire subject matter, their school year is over as far as this subject is concerned (More: Gajić, et al. 2006)

When organising the work, during the first month the teacher introduces his students to the aim, requirements and contents of the subject content, points to a relevant literature that is available and readily divided into the subject units. The teacher also introduces the students into the ways of studying according to MFT and its techniques. Each unit contains theses, explanations, examples for practice and questions. The students prepare themselves for the presentation and apply in accordance with their individual capacities, tempo and in following their plan and calendar of work. The students have the opportunity to evaluate their wn work, which is an exceptional value of this model, if we take into consideration that self-evaluation is more often more valuable and more objective than somebody else's evaluation. The very organisation of a teaching unit differs significantly from the classic one, above all due to the active role of the students. A class in MFT is dynamic because the students who have not applied their presentations actively participate in the presenters Q&A time and in the follow-up discussion.

Among the authors who have dealt with the MFT model and examined and surveyed the effects of its application, you can find dilemmas as per how innovative this model is, considering that didactic approaches and schools from as early as the late 19th and early 20th centuries emphasised the importance for the students' activities and individualisation in their work and the need for a different role of teachers. However, regardless to them, it is indisputable that the MFT supports the autonomy of students, enables them for independent acquisition of

knowledge and lifelong learning, develops a sense of responsibility to oneself and to others, teaches her or him what decision-making involves and what the basic principles of democracy are.

The exceptional value of MFT is the altered role of the teacher. All of the competences of the teacher, pedagogic, professional and personal have the same priority – they are conditioned with each other and are equally important in all of the phases of the teaching process. According to O. Gajić (2006) the teacher prepares the teaching material, has discussions with the students during their presentations, evaluates and marks their achievements. Also, he or she gives answers and additional explanations regarding the subject content if the students require so. It is considered that the teacher has now taken up the roles of a mentor, co-operate, partner and coordinator.

The MFT model implies, with all of the necessary competences, the teacher's immense engagement in the preparation of the learning process. The issue that cannot be avoided is whether the responsibility and the positive attitude towards this work, professional curiosity, wanting to advance the work is the sufficient motive for teachers, or should they be additionally encouraged so that the MFT can be present in schools to a greater extent.

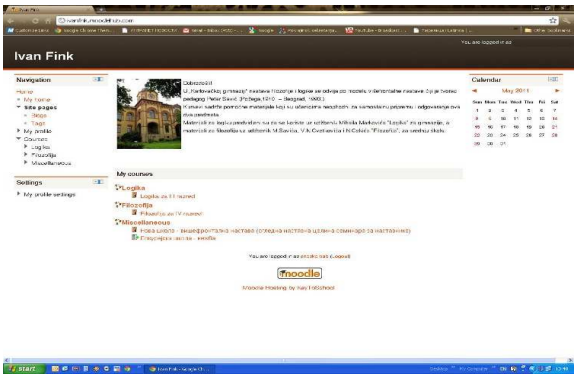
II ORGANISATION OF MFT WITHIN A MOODLE SYSTEM

Moodle (*Modular Object-oriented Dynamic Learning Environment)* is a flexible and fast system for distance learning (in the widest sense of the word) and electronic learning, which provides full computer-based support to teachers in the teaching process. We shall mention but a few possibilities that Moodle offers: creating a large number of courses (e.g. teaching material classified according to classes, topics and units) on one system; a calendar and schedule of activities; follow-up of the students' activities; work with the existing contents and resources; communication; testing the acquired knowledge; self-evaluation, evaluation, marks et al. In other words, Moodle is a standardised tool that enables active studying, communication between the teachers and the students and the enrichment and development of the contents.

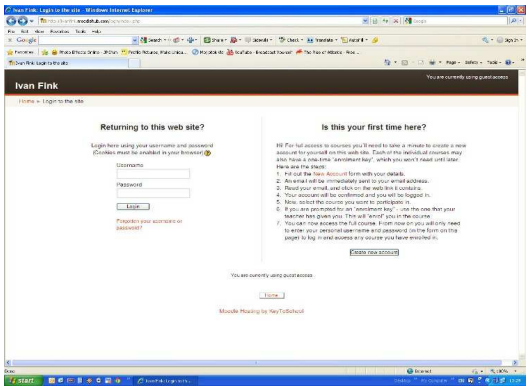
The opportunities that Moodle offers are exceptionally important for the organisation of work using MFT. The contents of the subject can be created in one system and divided according to the classes, units and activities of both the students and teachers, or according to the stages of the teaching process. The teaching material is always at the students' disposal on the internet, so that they can plan how to master the content and the process of acquiring knowledge, self-evaluation and evaluation and in addition to these they can 'go back' to the previously acquired content, following the principle of gradual learning and systematising the content acquisition.

We started teaching Logic and Philosophy in the third and fourth grades of the Karlovačka Gimnazija grammar school in Sremski Karlovci, based on features of MFT, activities of the students, the altered role of the teacher and due to the fact that it is possible to utilise the Moodle system. The teaching content and the material for the students' work have been set on http://ivanfink.Moodlehub.com .

The homepage contains basic data about Karlovačka Gimnazija grammar school, the courses, the MFT model and the materials necessary for the students for their independent preparation and presentation of the two subjects. It has been planned that the materials for Logic should be based on the Mihailo Marković's 'Logika' textbook for grammar schools, and the materials for Philosophy are based on the textbook 'Philosophy' for secondary schools by a group of authors (M. Savić, V.N. Cvetković and N. Cekić). The right column contains the work planning calendar.

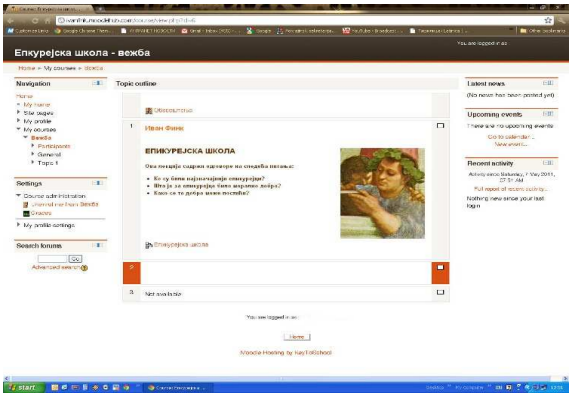


The left column contains links to courses with teaching materials. There is also an option so that non-registered users can have access to them, too.



Interface for access by registered users.

In the central part of the screen you can find instructions and information for the students on how to use the materials available on the interface: materials in PDF format have been prepared for the current school year, the rest are from previous years and can be used by the students who advance faster than others. During the year, these texts will, too, be changed or additional text will be written. At the same time, each topic will contain the tests planned for the exercise and the control of how well the knowledge has been acquired. Below are the tests for checking the acquired knowledge and evaluation, on the left side is information on various events.



Homepage for the unit on the Epicurean School

Besides the tests for each unit the interface for testing the knowledge and self-evaluation, contains the index of follow-up, evaluating and marking each student.

Pages intended for the professional improvement of teachers who wish to work using the MFT model add to the quality of this presentation. It also contains a glossary of didactic terms.

III CONCLUSION

Activities in overcoming the traditional, classical forms of teaching, which are still dominant in this country and in educational systems in the neighbouring countries, are directed towards the activities of the students in school. The model of Multi-Frontal Teaching by its author Petar Savić, encourages the students' autonomy and enables them for the independent

acquisition of knowledge and lifelong learning, develops the sense of responsibility towards themselves and others, and teaches them the skills of decision making and basic principles of democracy.

The exceptional value of the MFT is seen in the changed, non-traditional role of the teacher. All of the teachers' competences are they pedagogical, professional and personal and have the same priority, they condition one another and are equally important in all of the phases of teaching. The teacher is not a mere lecturer, but primarily a mentor, co-operative, partner and co-ordinator. The MFT model involves a changed engagement of the teacher in the preparation for a unit. One of the possibilities provided by the modern development of the information technology is the preparation, organising and managing the teaching process in the Moodle system. Organising the contents, which requires the teachers' thorough preparation and professional competence enables varied approaches in the work of both students and teachers. The teaching material is available in the electronic form and can be used in a Multi-frontal Teaching, and offers a possibility of E-learning.

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LEARNIG OBJECTS-WHICH ONE TO CHOOSE?

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Abstract - In this article the authors have tried to shed light on the following problem: “When designing and creating simulations or interactive animations there is an overall lack of well-defined developmental guidelines and of models which provide satisfactory/effective results.”

I. INTRODUCTION

Software visualization (SV) is “the visualization of artifacts related to software and its development process” [1] and is used in the presentation, navigation and analysis of software systems. Price presents the following general definition of software visualization: “Software visualization is the use of the crafts of typography, graphic design, animation and cinematography with modern human-computer interaction and computer graphics technology to facilitate both the human understanding and effective use of computer software.”

Given that the underlying purpose of algorithm visualization is to be educationally effective, it is noteworthy that eight extant taxonomic reviews of algorithm visualization and software visualization technology have focused largely on system expressiveness. In particular, these taxonomies have focused on three main questions [2]:

- What kinds of programs can be visualized with a given visualization system?
- What kinds of visualizations can a given visualization system produce?
- What methods can one use to produce and interact with visualizations?

The primary goal of visualization is to convey information. It should convey this information in an understandable, effective, easy-to remember way.

II. THE SOFTWARE VISUALIZATION

The lack of well-defined development guidelines and evaluation systems in the creation and design of software simulation and interactive animations may often result in the fact that the time spent with design, development and creation will be lost [3]. Namely, if the resulting interactive animation is given low from the users marks for usability, resulting in their not wanting to continue using the animation, the project can be deemed a failure. Similarly, if the animation’s role of knowledge transfer is not fulfilled, one can hardly talk about a successful project.

One possible reason for this could lie in the fact that many authors did not pay enough attention to the fact that the Computer Based Learning (CBL) is essentially a different learning environment from the classical frontal type of teaching setting [4], and there must be different approaches. There is some evidence [5] that very few e-curricula can overcome the negative effects which are likely to result from studying in an isolated and stand-alone environment.

In many cases the experts have focused on their own needs when planning and designing the animations presenting their own learning material [6]. Researches dealing with learning styles have established that there are differences regarding in what shape the learner is, how well they have acquired the material, in what pace the information is being provided [7]. If these factors are not in to the learner’s preferred style, the learning process will not be effective. This is proven by feedbacks from those users who study in this so-called Computer based education, they speak about whether or not the users are satisfied with the quantity and variety of e-curricula, but not with the quality.

The aim of this article is to focus on this problem. In this phase of the research the goal is not to evaluate other people's work or to develop the missing guidelines necessary for successful development. The problem described in this work is not only one of the developers of learning materials, but of those teachers who would like to incorporate already existing animations into their own electronic learning material. Learning object (LO) databases (CodeWitz project, Sulinet etc.) whose contents are readily available are quite common. Teachers can browse and freely choose from the Learning Objects for their own teaching materials. The basic questions remain the same: what factors should be taken into consideration when choosing the appropriate LOs? If the right choice is made, the learning material will be effective, in other cases not so much.

The reality of the problem is presented with an interactive animation. The animations deal with the same topic but they were developed by different people and according to different the development aspects. Two factors have been left out of the comparison, namely the amount of time and money spent on the development. Although it is difficult to present an interactive animation in static images, the screenshots below may be enough indication for the reader what great differences there are in the simulation representation of the same process. It cannot be determined which learning material is better or worse. All of the approaches have something positive about them. The authors of this work mean to indicate that the development of a convenient evaluation system is vital. If there were a way of telling or evaluating the impact that the interactive animation has on the teaching process, the developers and users would surely find those are extremely valuable pieces of information.

The first example presents a unique approach. The authors have done away with previous guidelines which can by and large be defined as follows:

An animation should have a great amount of

- multimedia elements
- interactivity
- information communication
- elements drawing the student's attention.

The starting point for the creation of the development of the first presented animations was the authors' experience described in the previous paper [8]. The following development strategies have been defined:

- The created examples have to be short program code sections, ones that are considered basic operations (e.g. function call, pointer arithmetic, storage allocation)
- The authors made an effort to minimize text elements and information: the program code should only contain the vital parts needed for the process to be visualized.
- The message of the animation needs to be illustrated graphically, keeping in mind that a single image speaks more than a thousand words.
- Animated elements ought to be used to point to those parts and processes where the changes happen.
- The level of interactivity needs to be reduced to the "absolutely necessary" level. This ensures that the user does not lose track of the main message of the animation.
- Control of playing the animation has to be provided: play, stop, and replay.
- The interface has to be consistent with every animation.

By keeping these guidelines in mind the authors aimed wanted to create such visualizations that carry the optimal amount of information while constantly keeping the student's attention on the message. It is true that one of the most useful options of interactive animations is for the user to learn through experimenting, however a different approach was chosen for this project. All elements which would obstruct the message or highlight something else were strictly left out. The option for speed control for playing the animation was not incorporated. The authors believe that when animating a sufficiently simple and short program code, speed will not play such as an important or useful role.

Data entry by keyboard was incorporated only in the animation where it was absolutely necessary, but where it was not absolutely vital for understanding the message, it was left out. The reason for this is the data entry option may at some point cause the user to try to crash the application by entering invalid formats and values. Further, the number of visual elements is also reduced, thus making it easy to follow the presented process.

The newly defined guidelines state that the animation ought to be:

- Only the necessary number of multimedia elements.
- Minimal amount of lateral information used solely for presenting the essence as simply as possible.
- Elements drawing attention that only point out the changes that have taken place.

Colors play an important role in creating an order within a given amount of information. At the beginning of the animation the entire program code is grey, as if melting into the background. As the program is executed, each program line turns into black, and an animated hand appears showing the currently active line. This serves to highlight the places where the changes occur. If there is an output the hand will point to the output screen, where the color will turn from grey (as if it were in the background) to black (bringing it to the front) and the output value will appear. The memory is represented by a simple ladder-like structure. By default all elements are grey, though once they become active they will turn into black (when e.g. a value is added in the section). The only memory cell presented by name and address is the one used by the program code. A further attention-grabbing element is a small sparkling green sphere which appears next to the active memory cell.

The first animation which will be presented is from Subotica Tech. Generally it can be said that the part presenting the program code is situated on the left hand side, while on the right there is a box showing the status of the memory.

Play controls (play, stop, and replay) are presented with three buttons. The screen showing the program results is a clearly defined box (see Fig. 1).

This animation presents how the parameter copies its value to the function's local variable with a function call. The message of the process is that there are two separate variables, and if the variable changes within the function, that does not affect the parameter in the function call. The two parameters are visualized and colors are used to point out that they do not exist simultaneously, and also the copying of value is presented.

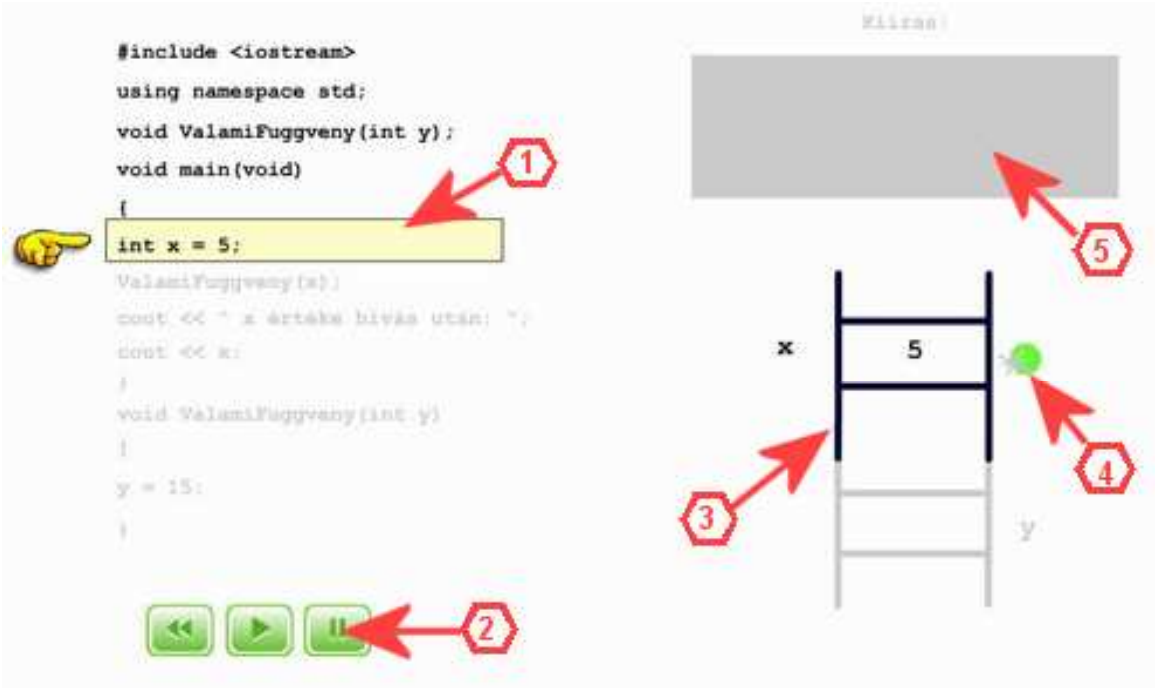

Figure 1. Screenshot of the animation from Subotica-Tech

Below is a description of the content and functions of the elements on the screen:

- Executed line of code
- Play control elements
- Simplified representation of memory

- Alterations marked by animated green sphere (e.g. writing in the memory cell)
- Space for presenting program output values

The other animations have been taken from the CodeWitz project's LO database. This project incorporates a collection of interactive animations developed at several European universities and colleges. Each author designed and developed their own auxiliary learning materials. Among others, the aim of the project was to make Learning Object from the database available for other educational institutions, as well, thus making their developing of electronic learning materials easier. The common feature in the following animations is that in the order of their presentation the amount of information contained is increasing, and is their scope of applications.

The following animation (by Esa Kujansuu, Institution: Tampere Polytechnic, Finland) portrays a different approach: the colors have the role to highlight the source code. Besides the window that contains the source code (1) three more windows provide the necessary information: the window presenting the output (2), the window showing the state of the memory (3) and the window portraying the results of the evaluation (4). In window (1) there is further information to each line of instructions.

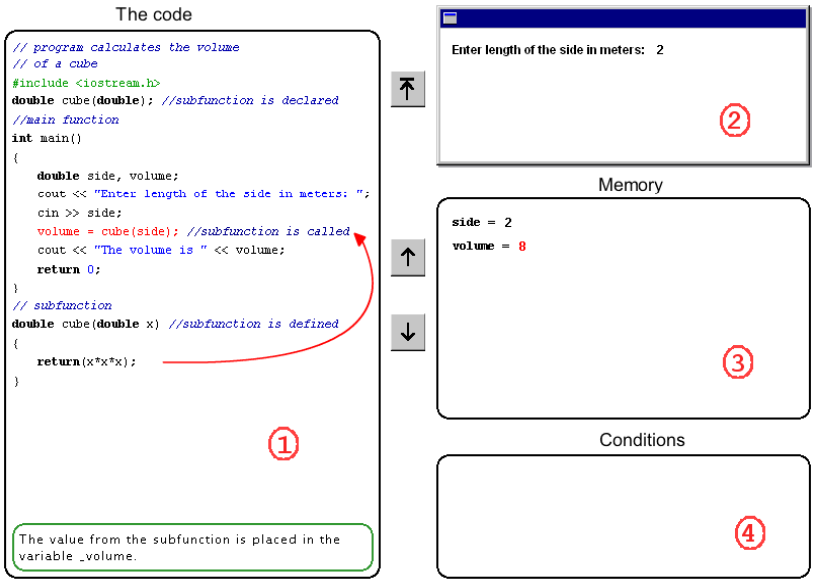

Figure 2. Screenshot of the animation from Tampere Polytechnic

In the next animation (by Julius-Christian Silard, Institution: Fachhochschule Furtwangen, Germany) the user interface consists of four dialog windows, the explanation of the exercise (1), a view on the source code of the example (2), the feedback window (3), where the LO may display the reaction of the LO to an input of the user, and finally the dialog window (4), where the user of the LO may input a reaction to a challenge of the LO or controls the LO [9]. In this application the besides the presentation of the main task, there user can also find and solve further sub-question connected to this topic. The authors have made this a condition of the further use of the simulation. For example, in window (1) the user is asked to correct a syntax error in the program before running the simulation. There is a unique 'hint' option that will provide help with the solution of the subquestion.

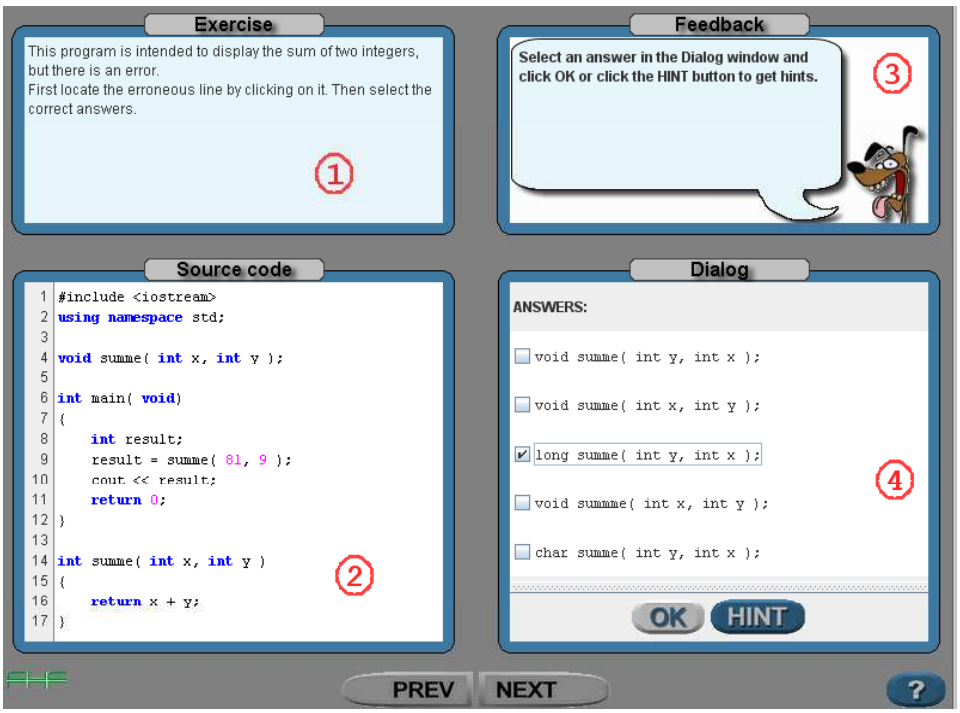

Figure 3. Screenshot of the animation from Fachhochschule Furtwangen

The next animation (by Tuukka Ahoniemi, Institution: Tampere University of Technology / Institute of Software Systems, Finland) also presents a Learning Object that is equipped with highly complex options. Similarly to the previous applications, this one contains the following:

1. the explanation of the exercise,
2. a view of the source code of the example,
3. the output window,
4. the window for presenting the variables
5. the window for presenting the result of the evaluation

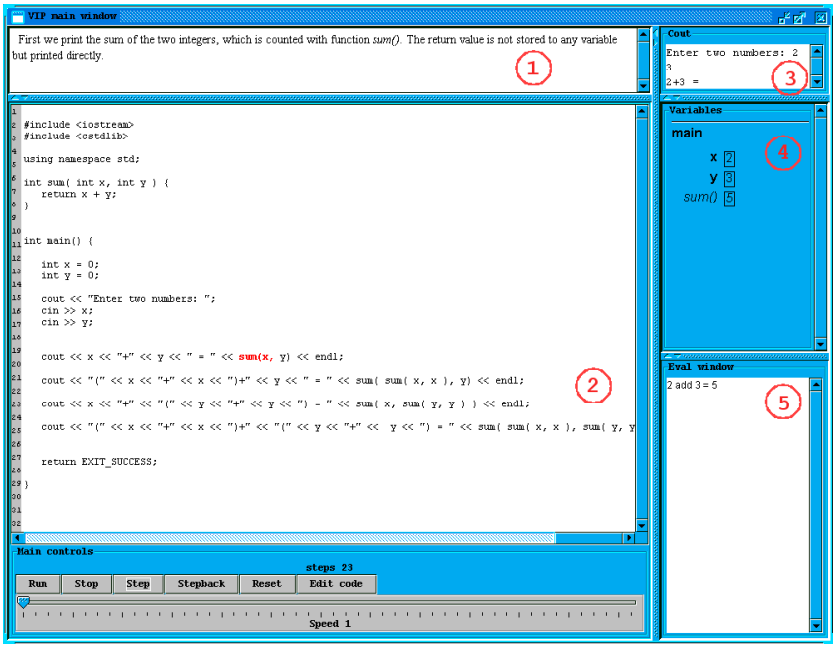

Figure 4. Screenshot of the animation from Tampere University of Technology

This application has the most options for controlling the simulation process. The user can "run" or "step-by-step" execute the program code. Further, they can edit and recompile the source code; while another interesting option is the ability to set the custom simulation speed.

III. CONCLUSION

The main claim of this paper is that in order to investigate this complex domain, multiple perspectives and methodologies have to be compared. Many research articles mentioned advantages of using interactive animations in education, but this only holds true if the design of the animation is satisfactory and the topic is adequate for presenting it in a dynamic form. This paper describes the problem of how to define the quality, or in other words, how to measure the effects of interactive animation on the learning process. The authors of this paper analyzed 4 interactive animations presenting the same topic: function call in C/C++ programming language. The animations were developed using different IT techniques and different approaches in the software visualization. One cannot determine beyond any doubt which the best is or the most effective in the learning process is. However, these animations raise a series of questions:

- Is the animation with a simple interface more effective in terms of learning than the one with numerous options? To what extent should the animation stick solely to the given topic? Or will a broad presentation of the topic provide better learning results?
- Can an order of importance be created among the software visualization options? E.g. how vital is the speed of the animation or the possibility for the user to enter various data into the program?
- Besides the visualization of the process, how much additional information is required for better understanding? In terms of presenting the source code lines, how much text and detail should it contain?
- What visualization methods are most effective? What methods are the best for presenting the execution of the program in an efficient manner? How best to focus the students' attention onto the message of the animation?

Due to the lack of a standard in creating successful and effective visual applications, the authors of this paper suggest that a evaluation and marking options ought to be integrated into the LO database. The ranking of Learning Objects created by the users, as a form of social navigation support may help answer the questions listed above. The experiences gained from well-accepted electronic materials may serve as guidelines for defining a methodology, which, if applied in the design of animations and simulations, will lead to greater effect and efficiency in the learning process.

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THE STRATEGY FOR IMPROVING CULTURAL VALUES OF THE YOUNG BY MEANS OF EDUCATIONAL SOFTWARE

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Abstract – This paper presents a modern approach to the strategy for improving cultural values of the young by means of educational software. The software which is the result of the analysis of National strategy for young people is described here. This software is designed by the students of Technical faculty »Mihajlo Pupin« in Zrenjanin, it is created for this type of work with young people and covers the field of gender equality.

I. INFORMATIZATION OF EDUCATION

Informatization of education is a term frequently used in pedagogy and it also represents the process which requests a synchronized institutional activity of all levels of management within educational system. Within National strategy for the young (we'll use Strategy in the text) in Republic of Serbia which was adopted by the Government in 2008 [1] young people were recognized as active participants of the society and their education was postulated as the state's priority. In the same document the stress was put on the necessity of developing mechanisms in the society for increasing the level of information literacy of the young. Information literacy assumes the basic knowledge in computer work and the ability for using aplications. The strategy's imperative represents the integration of Serbian educational system in European educational system.

In all countries, especially in developing countries, such as Serbia, the education and training of manpower is considered a cultural, social, economic and political development strategy. Economically, the education and training of manpower is considered a long - term strategy whose benefits have always been significant. Education plays several roles: first it prepares and trains skilled workers at all levels to manage capital, technology, services and administration in every sector of the economy. The education and training of manpower, on the one hand, is the most important means for development, on the other hand, it provides the substructure of all including development goals. Therefore, today, the role and importance of education of human resources is emphasized as a means to increase and hasten the speed of economic development.

International examinations [2] have shown insufficient quality of educational achievements of students in Republic of Serbia as well as their tendency to reproduction and not to research and problem solving. As a result, it is necessary to make formal changes in teaching programs and in methodic approach to teaching. Frontal work and traditional approach cannot respond to fast and multimedia requirements of students' perception in current social and civilization moment.

Introducing computers in teaching process can overcome these difficulties in communication and influence, in great deal, students' motivation and maintaining their attention. Combination of good and irreplaceable features of traditional teaching and modern methodic design of teaching activities (and free activities, too) represents a complex process which requires exceptionally great involvement of all management structures in educational process. Apart from its educational function school participates in upbringing of young people and modern social tendencies impose themes such as ecological consciousness, interculturalism, tolerance and sustainable development. Specific goals of the Strategy are: building the system of informing young people at all levels and in all fields, increasing the level of information literacy, making relevant information available, making and developing information programs for the young, reducing prejudice towards different social groups, systematic monitoring of problems, needs and attitudes of young people, increasing the number of young people who participate in different

kinds of formal and informal education, improving living conditions and developing safety culture among young people.

II. "COMPUTER CONSCIOUSNESS" OF YOUNG PEOPLE

The beginning of XXI century was certainly marked by exponential rise in computer using in all segments of computer action. Children, from their early age, are faced with digital devices and their upbringing goes along with them. Mobile phones, Internet communication, various types of electronic entertainment, availability of information are all parts of young people's lives. If the teaching process does not include these modern phenomena, it is strange and uninteresting to the young so it cannot give good effects. Consciousness shaping is directed towards multimedia perception, globalization and permanent search for the new. Schools still do not recognize these activities, they do not use valuable resources of Information technologies. Using computers in free time is completely without any control and it makes negative effects. Young people acquire new knowledge and experience mainly individually and diffusely. It is necessary to integrate all resources in educational system aiming at setting computers in the function of building a positive system of values among the young. Such integrated action should respond to real needs in the society: respect of human rights, interculturalism, equality, high level of health, ecological consciousness.

III. EDUCATIONAL COMPUTER SOFTWARE AS MEANS OF COMMUNICATION

It has been already proved that introducing computers in educational system has positive effects on children and that it increases the level of their motivation. However, the main requirement of educational technology is that computers are used properly, in other words, proper organization and methodology in relation to computer usage are necessary as well as appropriate didactic material (software). This software is called educational computer software.

Evidence whose validity has been proved by numerous scientific researches related to using computers in education show that a computer is the only means which can contribute to visualization and simulation of natural processes. Apart from technical possibilities, very strong evidence represents a high level of motivation which a computer itself achieves concerning young people. [3] When we say "computer" we think of educational software which is designed and licensed to be used in education. Criteria for designing educational software are nowadays defined differently in different countries and there are differences in methodology of their design. Evaluation aspects of software are also different, going from format, technical, educational and summarized. Each of them is equally important and it influences the final quality of software.

Teaching, as a form of human affair which deals with education and upbringing of young generations, is a complex communication process that influences directly the development of a society. The communication process in information includes teachers, students and contents which are being exchanged, as well as communication channels or media or even wider – educational technology. They are the elements of so far mentioned didactic square. Communication in education contains two crucial components: (1) information-knowledgeable component and (2) socially-emotional component. Students have certain information needs from both fields, they accept and interpret both information categories, react on them and forward these information.

Communication channels are similar to sensor acceptance of messages (visual, audio, tactile, etc.), types of messages (linguistic/verbal and non-verbal communication) and media for their transmission which may be natural (exs. voice, facial expression, etc.) and technical – in this concrete situation, computer one.

Computers are now only means capable to provide complexity of communication channels and to affect the formation of attitudes, belifs and models of behaviour.

Educational computer software combine verbal/notion and audio/visual information and in this way they enable:

- interactive learning, current correction of errors and determination of acquired knowledge and skills;
- help in creativity and development of other skills for problem solving such as determinatioin, persistence and step by step method;

- individualization and differentiation of work;
- emotional influence which directly affects the building of attitudes and consciousness formation.

Communication is performed by means of sending and receiving messages. A teacher sends information and receives them from students and a student/attendant is not only a receiver but he is a sender, too. Feedback information show how the sent information is accepted and interpreted by a receiver/student. Feedback information are very important because they enable control of the process of exchanging messages and the interaction among the students. The basic principle of communication in education is that a sender should adopt the message to a receiver. Processing of receiver's message can be the following:

- perceptive – makes conditional which information a student accepts by various sensor channels and the way he does it (attracting attention, aesthetics, contents reader-friendliness, etc.);
- cognitive – determines in what extent are presented information comprehensive to students;
- emotional – affects the student's emotions in relation to accepted information;
- associative – it is related to free associations that can appear in connection to certain information

In teaching communication the notions of authoritarian and democratic communication are very important as well as the notion of communication atmosphere/climate. **Authoritarian communication** is based on using superior position, power or influence of a teacher/instructor who decides what contents the students should learn and the method they should use. **Democratic communication** is characterized by respecting individuality, interests and independence of students, the possibility of mutual influence, adjustment of teachers/instructors to the needs and wishes of students, equality, development of democratic culture in mutual relations, encouraging students to express their opinions, suggestions as well as listening and respecting the others. **Communication climate** represents a general atmosphere in which communication is performed during educational process and it may vary on account of experience and the extent of freedom in relation to openness, sincerity and free expression of ideas, mutual relationship, the level of cooperation, accepting the others within a group, etc.

Starting from the very nature of the teaching process and the fact that one more crucial element is involved in didactic square – a computer, which is often classified in educational technology by many authors and sometimes identified with tutors or instructors, we are approaching a new didactic potential. Development of educational computer software points at the conclusion that maximum effects of applying computers are achieved in individual work. Therefore, development of educational computer software is mainly oriented towards individual interaction appropriate to knowledge, capabilities and tempo of individuals. For all these reasons different methodic solutions have been worked out which enable the use of program packages adjusted to personal features and wishes of students. These program packages provide students with a possibility to master educational content in their own tempo and with maximum effects.

Designing such software and respecting this methodic paradigm show that these program packages are efficient in the process of self-education.

These strategies have been made according to the world trends. Serious limitations in relation to limited time and financial means in schools as well as Informatics' struggle with other priorities have been considered. This model is for sure burdened with numerous problems because it is really reformistic in comparison to the previous models in all fields. It requires teacher training, innovations within curriculum, testing in classrooms, development of web site, making guide books and more challenges as well.

IV. THE EXAMPLE OF EDUCATIONAL SOFTWARE WITH CULTURAL CONTENT: EQUALITY OF GENDER

As an illustration of this theme the final-year-students from Technical faculty »Mihajlo Pupin« in Zrenjanin, Teacher of Informatics Department,

designed educational software whose purpose was not strictly linked to teaching programs but it represents an additional educative means directed towards shaping positive social consciousness of the young in accordance to directions determined in the Strategy for the young. The selected theme is Equality of gender.

The concept Gender equality is one of necessary conditions for achieving a balanced participation of men and women in decision making processes which can lead towards positive results in the whole society. It is also one of the most efficient ways for making political strategies, decisions and solutions which will improve the life of all population within a country and permanently represented their interests and needs.[2]

Building correct attitude towards this issue begins in the early childhood, in the family. However, in school age children form a priority attitude related to this issue.

The proof for actuality of this theme is the project of Institution for Gender Equality which has made the project "Gender Equality" and incorporated it in school plans and programs aiming at studying the current plans and programs in order to determine the way men and women are presented in them. Another goal is to find out if there is any disparity between boys and girls concerning possibilities for education and the available options.[3]

The software is designed for primary school pupils from 5th to 8th form. It may be used as an additional means in the subject Civil Education. The content of the software "Gender Equality" was designed on the grounds of National Strategy for the young. The guidelines for theoretic part of the software were taken from National Office for Employment, Subotica.

Figure 1. Intro screen

The structure of the software was designed to cover the following fields: Gender equality, Stereotypes, Prejudices and Discrimination. The program Macromedia Director MX was chosen for designing the software. Within this software there is an exercise which pupils should do and discuss the conclusions. At the end, there is a test for checking the acquired knowledge. The test is based on the lessons from the software.

The software is easy to use, it is multimedia, intuitive, easily navigated by the menu which also serves as the front page. It is adopted to a user in technical sense, fulfills hardware and software requirements (resolution of 800x600 (24bit) is the only requirement) so it does not cause any problems concerning the program work.

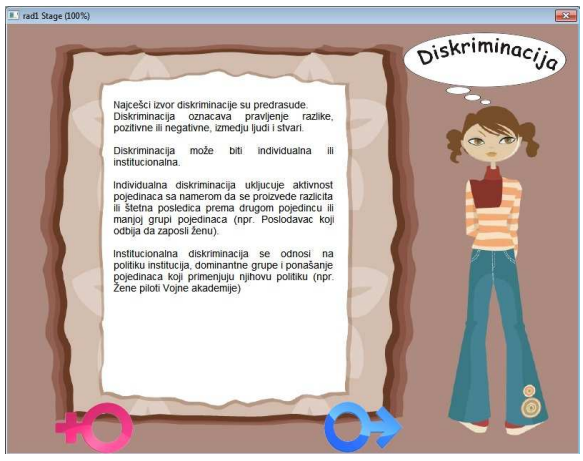

Figure 2.

The following steps are taken in order to make the work for the pupils from 5th to 8th form easier:

- The whole software is designed in order to motivate pupils –there are lots of pictures.

- Communication student-computer is performed through «mouse».

- Students can go back whenever they want to to repeat the lesson or they can go ahead to the next lesson.

By double click of the left button on the mouse the software is started and the introductory screen of «Gender equality» is opened.

Lesson selection is done by clicking the title.

After selecting the lesson the process of screen changing begins within the lesson and going to the next lesson is done by hand (by clicking buttons).

Moving backward –one or more steps - is enabled as well.

Last but not least, the role of a teacher is still irreplaceable as well as the work with didactic material.

Figure 3.

V. CONCLUSION

Communicating cultural values to young children is a part of every society. Educational software is one of way for young to learn about the cultural norms and values of a society.The new education age requires a modern approach to the strategy for improving cultural values of the young by means of educational software. This software which is described here is one of the the results of the analysis of National strategy for young people. The main problem here is extra time and management skills of teachers. The main goals of this works are:

- Be open to developing their knowledge and understanding of different cultural groups and of diversity within those cultural groups.

- Explore the impact of their own cultural background on the development of their values and beliefs.

- Reflect on how their own values impact on their approach to their work with families.

- Be aware of the limited value of stereotyping individuals from certain cultures or ethnicities.

The most important factor is to encourage young to interact with each other, and computer communication may be the best way to foster this interaction.

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