

The application of information and communication technology lessons in regards to multimedia presentations

Zoran Cekerevac¹, Svetlana Anđelić², Zdenek Dvorak³, Dragan Radovic⁴, Dragana Sajfert⁵

¹ Faculty of Industrial Management, "Union" University Belgrade, Serbia

² Railway College, Belgrade, Serbia

³ University of Žilina, Faculty of Special Engineering, Slovakia

⁴ Alfa University Belgrade, Faculty of Management, Novi Sad, Serbia.

⁵ Primary school „Sonja Marinković“, Zemun, Serbia

Abstract

Information and communication technologies (ICT) have become an essential element of the educational system both as a support to teachers in realization of traditional class work and as a replacement of the traditional class work with new methods of realization of the teaching process. This work focuses on multimedia and multimedia presentations as the most frequently used ICT in education. Some basic recommendations for creating a "good" multimedia presentation are given to secure that a presentation will not have a negative effect on students. The results of the experiment dealing with application of multimedia presentations in class work are also explained. Second part of the work shows the methodology of the research, experimental conditions and the results. Suggestions from the students who took part in the survey are given as a part of the analysis of the survey results. The conclusion summarizes the results and gives recommendations for improvement of the teaching process.

Key words: modernization, teaching process, multimedia, informatics, e-learning

Sažetak

Informaciono-komunikacione tehnologije (IKT) su postale sastavni deo sistema obrazovanja i to kao

podrška nastavniku u realizaciji tradicionalne nastave ili kao zamena takvoj nastavi jednom od brojnih novih metoda i načina realizacije nastavnog procesa, procesa učenja i podučavanja. U radu je, kao najčešće primenjivana IKT u obrazovanju, razmatrana multimedija, odnosno multimedijalne prezentacije. Da prikazane prezentacije ne bi imale negativan efekat na polaznike, izložene su neke osnovne preporuke za kreiranje „dobre“ multimedijalne prezentacije i prikazni su konkretni rezultati eksperimenta o primeni tih prezentacija u nastavi. U drugom delu rada dati su prikaz metodologije istraživanja, uslovi izvođenja eksperimenta i rezultati testiranja. U okviru analize rezultata sprovedene anonimne ankete izložene su neke sugestije anketiranih studenata. U okviru zaključka izvršena je rekapitulacija postignutih rezultata i date su preporuke za poboljšanje nastavnog procesa.

Ključne reči: modernizacija, obrazovni proces, multimedija, informatika, E-obrazovanje

1. Introduction

Information and communication technology, being a synthesis of development of computer, telecommunication and television technology, can be used in the teaching process in various ways, creating the possibilities for application of different strategies and methods in realization of the teaching and learning process (Anđelić, 2007).

One of the forms of application of ICT in teaching and learning processes is distance learning. Although heavily popularized in plans and analysis, this method has not yet been fully utilized in Serbia. There are several reasons for this, some of them being inadequate infrastructure, insufficient number of e-books, lack of trust in diplomas earned by distance learning and the problem of grading of student work.

There are various multimedia courses today, usually on CD or DVD. There are a large number of titles: from language courses, physics and history to work with text processors and so on. Multimedia courses are also becoming available from the Internet, which provides the users with up-to-date data (Čekerevac, 2009).

Application of information and communication technologies is a very significant, useful and creative didactic device which can successfully be applied in education. This work will analyze the application of ICT in the field of utilization of multimedia presentations in the teaching process.

2. The concept of modernization of the education process

In order to make the education process as efficient as possible, it is necessary to have an overview of all participants in the process and their characteristics. In this case, those are students, participants in courses, as well as former and older students having in mind the importance of life-long learning. This analysis focuses on students born after 1982. It was used the experimental method, and the analysis covered 200 students of the second year of studies. There was used two-stage stratified sampling method. According to the results of the analysis, some of the common characteristics of these groups of students are:

- They have been using computers since the age of five, 72% of students;
- Computer games are considered the favorite form of entertainment and recreation, 82% of students;
- 86% have their own computer, and 25% own more than one computer;
- They use Internet:
 - In the past month, 96%

- 16 hours per week on average;
- 91% communicate with their teachers by e-mail;
- 95% use email to communicate with their friends;
- 100% have Internet access from faculty/college, and 18% use it;
- 59% like Internet more than telephone;
- They feel they use Internet more easily than their teachers;
- They feel that technology is not adequately used in teaching process.

In Serbia, in the year 2010, 50.4% of the households have at least one computer (in EU 71%). 89.3% of the Serbian households own one computer, and 8.2% two computers. 39% of households is connected to Internet (in EU 65%). 45.9% of the population use Internet, and 72.3% of this number use Internet every day. These numbers are similar to those in other countries of the region. The only country that significantly differs in percentage of Internet users is Slovenia, with 62% in both categories (Vukmirović&Pavlović&Šutić, 2010).

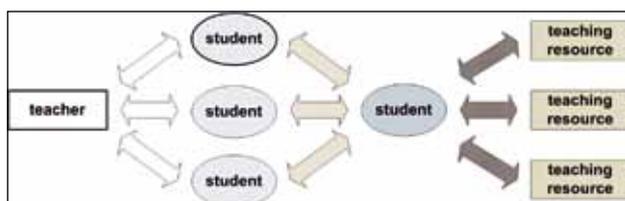
In order to make the education process as efficient as possible, it is necessary to have an overview of all participants in the process and their characteristics. In this case, those are students, participants in courses, as well as former and older students having in mind the importance of life-long learning. This analysis focuses on students born after 1988. It was used the experimental method, and the analysis covered 200 students of the second year of study.

The role of teacher in traditional teaching process is reduced to lecturing (presenting information), and control of knowledge through tests and exams. In such a system, the teacher is the main subject of the learning process, and the participants are the objects (Branković, 2003). The teaching process is focused on memorizing the information, which is one of the simplest and least requiring mind functions. This position makes the students feel passive and slows down their progress and development. One of the main reasons for poor efficiency of the learning process is poor communication in the process. During 4/5 of the class the information flows from the teacher towards the students, and there is very little commu-

nication in the opposite direction. There is almost no horizontal communication, where students exchange information among themselves.

In traditional teaching, the frontal model of work where equal content is presented to, by the level of prior knowledge, unequal participants prevails. This kind of teaching is not differentiated and individualized. It does not take in consideration capabilities, interests and needs of different students. It aims towards the average student, and it is usually too dynamic for those with little prior knowledge and too slow for the ones with prior knowledge, which makes it unsuitable for both groups. Since the feedback is usually left out, sporadic testing of student's work is the basis for the evaluation of knowledge. This kind of testing however is not reliable when it comes to evaluation of student's progress, evaluation of teacher's work and improvement of the teaching process.

The new teaching paradigm is learner-centered, and its scheme is given on picture 1. The student is "positioned" in the center, while the teaching resources (covering place, time and the way of learning) are around them. Everything is focused on the student, and all the relevant factors are covered by a single term – the teaching resources (people, knowledge, technology, media, organizations...).



Picture 1. The shift from a traditional teaching paradigm to the newly advanced one (Anđelić, 2007)

The student is the central subject of the process, which means that the methods of work and teaching, communication, evaluation, feedback and whole interaction are designed according to student's interests and capabilities.

The teacher is becoming an adviser, guide and motivator of the students in the process of acquiring knowledge and developing the ability to think critically, act creatively, understand and solve problems and apply their knowledge. The main goal of education is not only to have students

memorize the facts, but to prepare students for further education and development. Modernized approach to high education is realized through technological means such as Internet and intranet, along with technological control of the educational process itself.

This way of work has enabled interactive learning during the lectures. Instead of listening to traditional lectures and do standard class work, the students are given opportunity to prepare for lectures and mutually discuss everything that they find unclear. This approach results in student's switching from passive to interactive learning.

Interactive (cooperative) learning is realized in different models(Vlahović, 2000):

- Student-student
- Student-teacher
- In small or big groups, as well as in plenary work with all course participants
- On different levels of complexity
- In exemplary teaching, programmed teaching, and different kinds of developing teaching (discovering, problem teaching, interactive teaching student-computer)

One of the characteristics of cooperative teaching is that everybody teaches everybody and that the roles of the participants change during work. The teacher acts from background, guiding and motivating the students to be active, efficient and effective. The goals of this type of learning is development of communication and cooperation, tolerance and democratic relations, responsibility, free speech, mutual trust, team work and socialization.

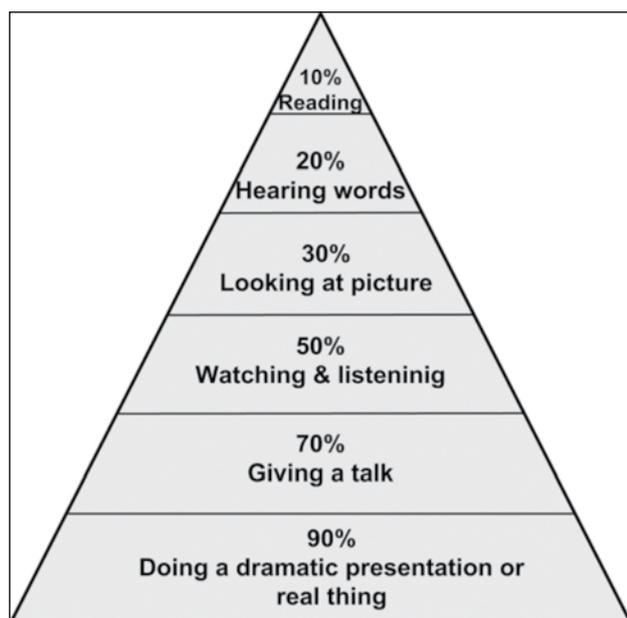
Efficiency of the teaching process is measured by the use of time and energy of teacher and students on working on a subject. The teaching that enables the maximum of reliable and long lasting knowledge with minimal use of time and energy is the most efficient. (Vilotijević, 2001)

3. Multimedia in teaching process

3.1. Dale's pyramid

Dale (Dale, 1946, 1954, 1969.) and some other researchers (J.D., 2006) found that people remember:

- only 10% of what they read
- 20% of what they hear
- 30% of what they see
- 50% of what they simultaneously see and hear (watching pictures, acts or demonstrations)
- 70% of what they say (drama, role playing, reading/writing about an issue)
- 90% of what they do (doing something for real, accomplishing specific goals, searching for a solution)



Picture 2. Dale's pyramid of experience (Hartopp, 2000)

These data show that students can remember only 20% of what they hear. Therefore, we come to a logical conclusion that the traditional way of lecturing is not adequate. The lectures should be organized in a way that will simultaneously activate different senses for perception of new data and information.

3.2 Multimedia and E-learning

The word multimedia is often used inadequately. Many believe that it means the use of electronic media in the educational process. The correct use of the word multimedia is use of the word when speaking about information that has multiple meanings. This kind of information uses

different media, and simultaneous use of different senses is necessary for its perception. Multimedia is a method of presentation of information through application of digital media.

Multimedia elements are various forms of monomedial writing and they have their place in many fields, from web pages to program packages for playing and studying. Modern technologies use human visual and hearing capabilities to establish interaction.

Multimedial flow of information is intensive and in terms of manifestation and transmission routes diverse and simultaneous flow of information between the performer and the participants in the event. Multimedial informational system in interactive communication with the user simultaneously uses various forms of information: text, graphics, animation, still or motion pictures, music and speech.(J.D., 2006)

Multimedial technology covers input/output units for automatic gathering of data from the environment, such as video camera, microphone, scanner etc. They generate multimedia entities: video, audio, pictures and so on.

One of the main goals of the application of multimedia is to give the opportunity for interaction with the source of information in a manner that is most suitable for the consumer.(J.D., 2006)

Multimedial teaching requires dynamic, active and direct teaching concepts. Video technology offers many advantages: it increases the productivity of the teacher, encourages participative style of teaching, promotes and optimizes the highest ideals for improvement of education. In global and open virtual space, the teacher passes on his main role to the students, and becomes a guide through the teaching process and a navigator in the ocean of information.

Materials with visual, audio, audio-visual, and multimedia content can be used very efficiently in E-learning. *Visual content* can be in form of text, drawing, graphics, models, scale models etc. *Audio content* can be oral lecturing, musical background, different sounds and sound effects. *Audio-visual content* combines the named elements, most frequently in form of TV show, film, or video. Multimedial content combines all these and computers, CD, DVD and the Internet are used for reproduction and storage.

In order to successfully use the multimedia elements in education it is necessary to know what kinds of those elements are suitable for individual students. Each student has specifically developed intelligence and unique experience, and the type of learning that is most suitable for him/her is also specific. (Anđelić, 2007)

It is neither recommended nor necessary for textbooks made for traditional lecturing to be merely reproduced on the computer screen. Success of the multimedia class work requires a new digital language that combines technology and pedagogy, mutually enriching dynamic synthesis that evolves in favor of new ways of teaching and lecturing. The teacher has to master the level of knowledge that will allow them to design the multimedial material in the best possible way and at the same time be the support to the students so that they can overcome the technological barriers.

3.3 Recommendations for design of multimedia presentations

Educational content for multimedia presentations should be prepared according to the following principles(J.D., 2010):

- *Interesting and useful text* with examples, short exercises and quizzes;
- *Comprehensible content* with adequate explanations of less familiar and new elements
- Visualization of content of complex nature through graphs, schemes, models etc.
- *Dividing content into “chunks”* that are most suitable for presentation on computer screen
- *Interactive work with “chunks”* and other pedagogical elements for adoption of educational content
- Content should be well organized and presented clearly
- *Use of animation, simulation, sound and video* and video recording of the lecture when possible

Attractiveness and understandability of the course are the main indicators of its quality. The way of expression during a course needs to be adapted to

specific conditions of the educational environment and the capabilities of the student. Having in mind that every science has its own signs and symbols and its own language, the author of the course has to adapt the language of science to the student. A text is understandable if the language it is written on is adapted to the user (vocabulary, new and abstract terminology, the length and structure of the sentences), if the idea of the text is clear, if the text is well structured and divided into smaller, easily read parts and if it is concise.

The basic principles for creating multimedia presentations are(Svetlana Anđelić, 2008):

- Clear colors have advantage over mixed colors
- Use of three colors is optimal
- HTML documents should not be too long or too short (user can “get lost” in a large number of small documents)
- A balance between text and other elements should be found when working on development of hypermedia application
- A presentation that looks perfect from the esthetic side, but is empty in content and does not

Characteristics of good and bad design are shown in Table 1.

Table 1. Characteristics of good and bad design (Anđelić, 2007)

Good design	Bad design
Interactive	Passive
Non linear	Linear
Easy to use graphic interface	Confusing interface
Structured lectures	No structure
Use of multimedia	Text prevails
Pays attention to educational details	Does not pay attention on details
Pays attention to technical details	Does not pay attention to details

The following recommendations can help create a presentation that is easy to read (J.D., 2008):

- *Font* – clear and simple fonts should be used; some of the suitable fonts are Ariel, Vedrana and Tahoma; Italic font should be

- used instead of Bold or Underline options; long texts and scrolling are not desirable
- *Font size* – the recommended font size is 18 to 36. The font size is adequate if a printed slide set on the floor can be read by a person standing above it.
- *Big letters* – Big and small letters should be combined; text written only in caps can be hard to read
- *Colors* – It is a good idea to use blue color as the background color and yellow and white for the text. Red is too strong and black is hard to read on a dark background. If a video projector is used, it should be checked how the colors look on the projected presentation, since the projected picture can differ from the original
- *Page layout* – use of horizontal (landscape) layout is recommended
- *Amount of content* – each page should contain only the minimum of information. Usual structure is up to 6 lines of text with five words in each line. If the slide is too complicated and complex, the student will pay too much attention to the slide and not listen to the lecturer.
- *Special effects* – sound effects and animation should be avoided for the reasons mentioned above
- *A good presentation does not change slides automatically!* There is a simple reason for this – it is almost impossible to synchronize the automatic change of slides with the communication between the lecturer and different students

No presentation can match the taste of every student, but the guidelines should be followed in order to keep the students focused and to enable the transfer of the message.

4. Research results

4.1 Experiment overview

The experiment was conducted at the Railway College in Belgrade, Serbia. Two hundred participants in the experiment were students of the sec-

ond year of studies at the Informatics departments of Railway College, who attend the class Object programming – C++. The sample was divided in two groups: the experimental group and the control group. Students were divided in the groups by the index number, and the size of the sample was conditioned by the overall number of the students attending the class.

Before the beginning of the experiment, students were introduced to the procedure and the purpose of the experiment. Students were also given a brief description of the experiment in written form.

There are three parts of the experiment:

1. In the first part of the experiment a lesson titled “Use of programs for detection of logical errors” was presented to the groups. The experimental group was presented the lecture through multimedia presentation, while the control group attended the traditional model of the lecture. The multimedia presentations were created in Macromedia Flash and presents an animation of the computer screen where the programs for error detection were started, along with adequate voice comments. Both lectures were around 30 minutes long.
2. Second part of the class consisted of:
 - Test of knowledge (with goal to evaluate the amount of content learned) and
 - Filling the survey form (with goal to get feedback from the students and recommendations for application of multimedia presentations in teaching)
3. Third part consisted of doing the same test from the second part, but 15 days later. Students were not informed about the second testing, which was supposed to prevent them from preparing for it.

4.2 Test results

Test of knowledge aims to measure the level of knowledge from the field of object oriented programming (C++). The test is anonymous and consists of 14 questions regarding the content taught in class under the name “Use of computers for detection of logical errors”. At the beginning of

the test the students were informed that the results of the test would not affect their grades. Students were given 30 minutes to do the test. Both groups had to answer the same questions.

The test consisted of different types of questions. Students were expected to answer each question in a certain manner:

- Fill-in-the-blank (6 questions)
- Multiple choice – one correct answer (6 questions)
- Multiple choice – multiple correct answers (1 question)
- Connect the functional symbols from left column with matching meanings in right column

The questions that were answered correctly by the biggest number of students were the multiple choice questions with one correct answer (71.67%). The questions with smallest number of correct responses were fill-in-the-blank questions (64.17%). This outcome is understandable, since recognition of learned content is the first level of knowledge adoption. The questions where students were expected to fill in the blanks required a higher level of knowledge. (Table 2)

Table 2. Percentage of correct responses to different types of questions

Content presentation Types of questions	Multimedia	Traditional way
Multiple choice – one correct answer	77.78%	62.50%
Fill-in-the-blank	61.11%	68.75%
Visual memorizing (questions 5 and 11)	95.83%	70.83%

It is interesting that with multiple choice questions such as:

- “The red dot before a line of code marks Break Point?” and
- “Line of code where program execution is stopped is marked with one of the following arrows:“

Where visual memorizing is required, the experimental group gave a bigger number of correct answers (95.83%) than the control group (70.83%). (Table 2)

Each test was evaluated individually, and the percentage of adopted knowledge was evaluated for each student. Average values were calculated for each group, in order to determine the differences.

Positive effect of application of multimedia can be seen in the fact that the level of adopted knowledge in the group that used multimedia presentation during the lecture was 71.00%, while the group of students who listened to the traditional style lecture had 66.67%. (Table 3)

Table 3. Percentage of adopted content

Content presentation Test Results	Multimedia	Traditional way
First testing - after the lecture -	71.00%	66.67%
Second testing - after 15 days -	67.33%	66.67%

The test was repeated after 15 days, and the results were slightly different. The percentage of memorized content decreased in the group that used multimedia (67.33%), while it remained on the same level in the other group (66.67%). (Chart 3)

It can be seen that the students who used multimedia presentation in class work showed significantly better results in the first testing (Graph 3.), and that they still performed better on the repeated test. The decrease in percentage of memorized content demonstrated in the second test just proves the Latin saying: *Repetitio est mater studiorum*. The impression from the presentation has been covered by other impressions during the following days and the knowledge stocked in the cache memory of the brain has gone away due to the lack of use. It can be expected that it would require less effort to maintain the knowledge for a student from the experimental group than for a control group student to expand the knowledge. Therefore, the overall results of the work would be better with the students from the group that used the multimedia presentation. Besides the mentioned, it should be kept in mind that the students are more used to the traditional way of learning due to their prior experience in education, and that learning with use of multimedia is still a relatively new thing for many of them. It is possible that the results will improve as students are becoming more familiar with the new learning conditions.

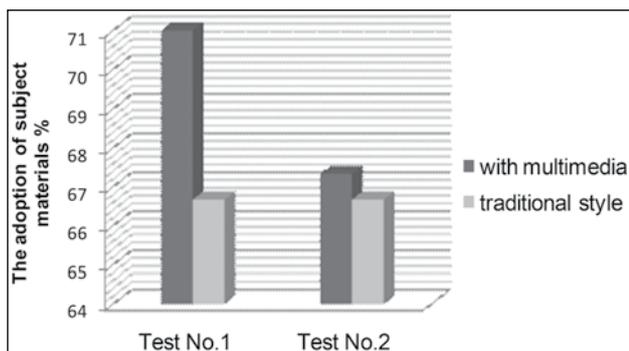
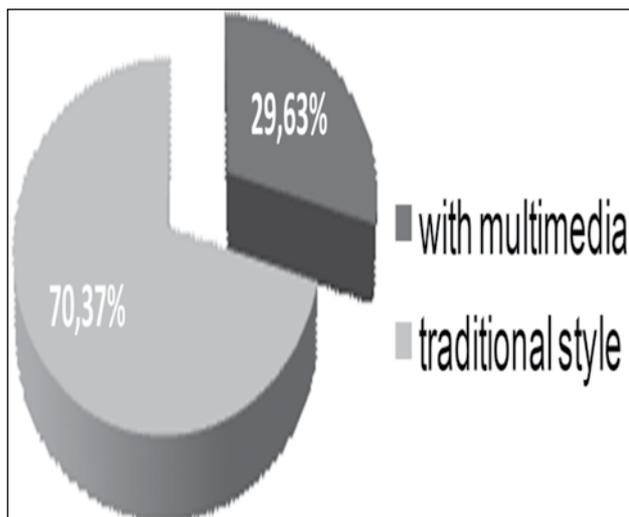


Figure 3. The adoption of materials exhibited

4.3 Results of the survey on application of multimedia in class work

After the first test, the students anonymously filled in a questionnaire. The questions in the questionnaire dealt with the use of multimedia presentations in class work. The questions were supposed to give an insight in thoughts and suggestions of the students. Both groups filled in the questionnaire. Students were told that the questionnaire was anonymous. The students were given 10 minutes to fill in the questionnaire.

The questionnaire consisted of six questions, four of them being essay questions. First two questions were general, and regarded the overall number of courses taken and the number of courses that used multimedia presentations in class work.



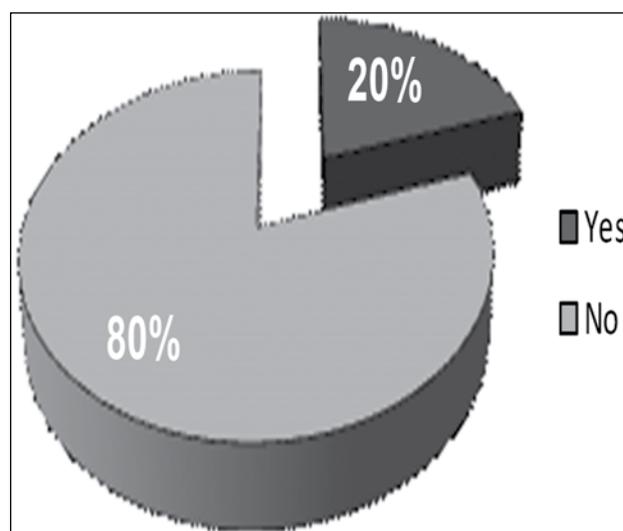
Picture 4. Ways of organization of teaching in Railway College - Belgrade

The students had taken 27 courses at the time of survey. They responded that professors used mul-

timedia presentations in only 8 courses, which is 29.63% of all courses taken up to that point (Graph 4). In 85.00% cases (of the number of classes that used multimedia presentations), MS Power Point presentations with text, animations and graphics were used.

When asked whether they liked the presentations that were used in their courses, 80.00% of the student answered that they did, as shown on graph 5. Students explained their answers as follows:

- The presentations draw their attention, and they help them maintain focus on lecture;
- They are dynamic, and not monotonous;
- They are concise and focused on the most important elements of the lecture;
- They address different senses, which results in the better picture of the presented content;
- The content of the lecture is easier to memorize, especially when pictures associated with the text are included;
- Presentations contain material that is needed for the preparation of the exam.



Picture 5. Answers to the question: "Do you like shown multimedia presentations?"

Students who said they did not like the presentations gave the following explanations:

- Insufficient participation of the students
- Professor reads the text from the presentation, often very fast, the lecture is monotonous, students cannot focus on the lecture and the information is hard to memorize.

In the last question of the questionnaire, the students were supposed to write their suggestions for improvement of the class and lab work. Some of the suggestions were:

- More multimedia presentations with animation should be used
- Students should be engaged in group projects in order to practice team work
- More lab work and more practical experience
- Tests of knowledge should be more frequent

5. Conclusions

Present time, so called *the age of information*, is characterized by a high pace of changes and big speed of everyday life. With estimation that around 85% of today's jobs requires additional education, the need for permanent learning is emphasized. One of the possibilities suitable for the new environment is E-learning as a new concept of education.

Information and communication technologies have become a part of the educational system as support to the lecturers, as well as a replacement for the traditional way of lecturing. There is constant progress in the field of multimedia, computer networking and program engineering. This has enabled development of a new generation of learning systems based on use of computers.

The results of the survey show that less than 30% of lecturers use multimedia in their lectures, which is a low percentage for XXI century and the age of information. Unfortunately, even the lecturers who use multimedia presentations mostly use them inadequately, and further education in this field is necessary.

The sample is relative, since the experiment was conducted in a school that ranks high by the amount of computers and related equipment.

The survey has determined that the level of adoption of knowledge is temporarily increased when multimedia presentations are used (71.00%), but that repetition is needed to prevent the reduction of adopted material (67.33% after 15 days).

This experiment and the results of similar experiments lead to conclusion that advantages of proper use of multimedia are undeniable, both from the aspect of motivation of students and the aspect of knowledge adoption.

The goal of this work to contribute to the quality of realization of the learning process in educational institutions is fulfilled because the work shows lecturers, pedagogues, psychologists and all other participants in the educational process in what direction programs of realization of the teaching process should be developed and corrected in order to make the best use of the information and communication technologies.

References

1. Anđelić, S. (2007). *New Approaches to Learning Through Applying Modern ICT. International Scientific Conference UNITECH'07. Gabrovo, Bulgaria: UNITECH.*
2. Anđelić, S. (2007). *Savremene informaciono-komunikacione tehnologije u obrazovanju - Magistrski rad [Modern information and communication technologies in education - master's thesis]. Beograd: FON.*
3. Vukmirović, D., & Pavlović, K., & Šutić, V. (2010). *Usage of Information and Communication Technologies in the Republic of Serbia, 2010.* <http://webzrs.stat.gov.rs/axd/en/dokumenti/ict/2010/ICT2010e.pdf>
4. Anđelić, S., Kasalica, S., & Vujačić, G. (2007). *The application of modern information-communication technologies in education at Railway College in Belgrade. Academic journal Mechanic, Transport, Communications* , XI 42-46.
5. Čekerevac, Z. (2009). *Internet tehnologije i Internet poslovanje [Internet Technologies and Internet Business]. Kruševac, Serbia: FIM ICIM+.*
6. Dale, E. (1946, 1954, 1969.). *Audio-visual methods in teaching.* New York: Dryden Press.
7. Hartopp, B., & Farrell, S. (2000). *New didactic media in teaching. Interaktivno učenje II* , 18-24.
8. J.D. (2008, 12 04). *CARNet . Retrieved 01 23, 2010, from CARNet - Videokonferencije - Videokonferencije: <http://www.carnet.hr/videokonferencije>*
9. J.D. (2006, 08 25). *CARNet. Retrieved 01 23, 2010, from Izrada multimedijalnih elemenata i njihova prilagodba za www: <http://www.carnet.hr/referalni/obrazovni/imme/mmelem.html>*

10. J.D. (2010, 01 23). CARNet. Retrieved 01 23, 2010, from CARNet Referalni centar - Metodika i komunikacija e-obrazovanja - Izlaganje sadržaja: <http://www.carnet.hr/referalni/obrazovni/mkod/metodika/procunas/izlsad>
11. J.D. (2006, 05 01). Will at Work Learning: People remember 10%, 20%...Oh Really? Retrieved 01 25, 2010, from Will at Work Learning: http://www.willatworklearning.com/2006/05/people_remember.html
12. Sajfert, Z., Djordjević, D., Besic, C., Nikolic, M., Cockalo, D., Kljajic-Dervic, M., : Researching needs for marketing managers in Serbia, *Tehnicos Tehnologies Education Management*, ISSN 1840-1503, Vol.5. No.2, 2010, [286-295]
13. Egic, B., Tasic, I., Sajfert, D.,: The research of the management process of the primary schools headmasters in Serbia, *Tehnicos Tehnologies Education Management*, ISSN 1840-1503, Vol.5. No.4, 2010, [813-820]
14. Svetlana Anđelić, D. A. (2008). Kako kreirati "dobru" multimedijalnu prezentaciju [How to Create a "Good" Multimedia Presentation]. 13. Kongres JISA DSCG (pp. X-11 - 14). Herceg Novi, Montenegro: JISA.
15. Vilotijević, M. (2001). Interaktivne multimedijalne učionice. *Obrazovna tehnologija* , 1, 1-11.
16. Vlahović, B. (2000). Kooperativno (interaktivno) učenje [Cooperative (Interactive) Learning]. *TEACHING INNOVATIONS* , XVII, 3, 1 -7.
17. Vukmirović, D. (2009, 09 24). Povecan procenat koriscenja racunara i Interneta u Srbiji. Retrieved 01 23, 2010, from Personal magazin: <http://www.personalmag.rs/it/povecan-procenat-koriscenja-racunara-i-interneta-u-srbiji/>

Corresponding author

Zoran Cekerevac,

Faculty of Industrial Management,

"Union" University Belgrade,

Serbia,

E-mail: ttem_bih@yahoo.com