

Pedagogical and Didactic-Methodical Aspects of E-learning

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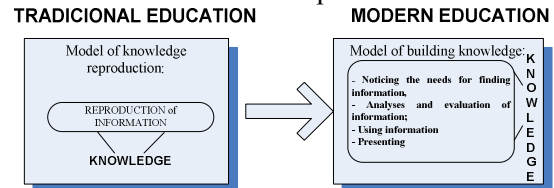
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Abstract: - In the process of implementing information-communication technologies (ICT) in teaching the focus is, most often, on technical components of the system. However, such a system cannot have educational qualities, it cannot be sustainable or give the expected results without adequate pedagogical and methodical approach. This paper gives a review of definitions and comprehension of E-learning; the results of implementing information technologies in schools in Vojvodina (Serbia); pedagogical aspects of E-learning; didactic-methodical questions of E-learning, as well as possible ways of organizing teaching materials for E-learning. The conclusion obtained by research and analyses of the available literature clearly shows the necessity for assimilation of new learning paradigm based on new information technologies usage.

1. Definitions and Comprehension of E-learning

Modern education demands transformation of "traditional model of knowledge reproduction" into a model of "active knowledge building", where teachers and students are partners in the common action towards building a knowledge bases which should be assimilated. We consider the attitude which proposes that giving information to students is equal to giving knowledge a wrong approach to computer using. A new era is imposing "Life Long Learning", where active individuals are forced to transform individually collected information into knowledge. They should be taught not only to search for information themselves, but also to manage them, analyse and transform into useful knowledge. The role of school teacher is being changed: He/she stops being the center of the classroom where frontal teaching is performed and becomes the associate,

instructor or trainer who helps his students to study in their own way and successfully transform information into knowledge. The main task of a teacher is to teach his students how to study, in other words, to create information literate students and future information literate experts in their fields.



Picture 1.

Information literate person understands the role of computers as associates in the process of searching and processing information, but he is equally conscious of the fact that success of the process depends mainly on him and not on the used technology.

New, different names for open, flexible and distributed activities in the process of learning and teaching are appearing in this technological and didactic moment:

- E-learning,
- Web Based Learning
- Web Based Instruction
- Internet Based Training
- Distributed Learning
- Advanced Distributed Learning
- Distance Learning
- On-line Learning
- Mobile Learning
- Remote Learning

E-learning is the most common name because it includes a paradigm of learning based on electronic technology as well as everything else that has been used during the development phase of computer technologies applied in learning and teaching

process. Thus, this name provides a historical dimension of educational systems' development.

Electronic learning can be simply understood as " a process of knowledge and skills transfer over the web by using computer applications and the environment /surroundings in the learning process. These applications and processes include learning on the web and computers in digital classrooms, as well as digital collaboration with other participants in the teaching process. The contents are transferred over the Internet, intranet, video conference systems, audio and video tapes, satellite TV, and CD-roms. From the standpoint of technology, electronic learning includes a series of fields of web intelligence like the use of information systems on the web, ontology engineering, Semantic Web, interaction of humans and computers and computer media, managing information on the web, browsing and finding out information and knowledge on the web, web agents' autonomous systems, web mining and building new types of applications [2]

2. Electronic Learning As A Necessity Of Modern Society

"Internet has fundamentally changed practical and economic reality of scientific knowledge and cultural heritage distribution. For the first time Internet gives us a chance to create global and interactive presentation of the human knowledge, including cultural heritage and a guarantee of availability". [3] Nowadays, Internet represents a broad field with numerous possibilities for learning and teaching. Progress and development of multimedia tools have influenced this trend significantly which increased the number of educational resources (e-texts, pictures, films, simulations, animation) developed in Internet field.

What is the condition like in our educational system concerning modernization of the teaching process? The following data are based on the answers of the surveyed teachers and on indirect analyses of available and appropriate documents. The main documentary sources are:

A) «Overall analyses of the system of primary education in Federal Republic of Yugoslavia», UNICEF, Belgrade (4)

B) A project of Ministry for Education and Sport, made by Educational Forum under auspices of

UNICEF «Optimization of school network in Serbia»(5)

By analyzing the surveyed teachers' answers it was concluded that the predominant form of teaching in our school system is a frontal way of teaching. The data show that the teachers mostly use the frontal method of teaching, then a pair work and finally a group work.

By analyzing the available documents we came to the similar conclusions. The analyzed documentary source A shows that "traditional ways of teaching are predominant in our school system". Specific characteristics of Informatics (as a school subject) didn't contribute to essential changes concerning modernization of teaching methods and the predominant method of teaching in Informatics is still the frontal method of teaching. However, certain schools and teachers that showed successful attempts in modernization of their teaching approach mustn't be neglected. By analyzing a documentary source A we came to the same data: "It is a fact that in our schools a classical approach to a teaching process is still predominant and the main philosophy of teaching is traditional". Such an approach is characteristic, among the others, for traditional methods of teaching. All the mechanisms of our school system which can influence the method of teaching and learning mainly give favour to traditional methods where teaching methods are most commonly used. The point is in the role of teachers – not of students. It has already been said that the predominant teaching method in our schools gives favour to mechanical memory. A strict learning of subject matter is still focused at pure reproduction of the taught contents and not at practical skills and abilities. It often happens that (according to the survey) evaluation is performed on the base of pure contents reproduction in front of the board, and not on computers or other modern equipment.

The analyzed teachers' answers (incorporated in the doctoral thesis defended at Technical Faculty Mihajlo Pupin in Zrenjanin)(6) showed that nearly 70% of the surveyed teachers was unsatisfied with computer equipment they had, while 10% of the teachers said that the complete teaching of Computer Science was performed without computers.

3. Pedagogical Characteristics Of Electronic Learning

Pedagogically speaking, what are the changes and possibilities that e-learning brings?

1 Flexibility of time and place in attending classes. While in traditional educational system a geographic compatibility was a necessary element of the teaching process, today it is totally unimportant. It is no more important that all the participants in educational process are located at the same place in the same time. Taking into consideration place and time we can differ several types of performing teaching:

- The same time and place (classical classrooms with multimedia presentation)
- The same time but different place (video conferences, chat rooms)
- Different time, the same place (work stations, bulletin boards)
- Different time, different place (e-mail, web-forums, video-conferences, shared data bases, individual web-sites for learning)

2 Interactivity in communication: student-student; student-teacher; students-teacher. Several ways of communication must be provided if we want e-learning to be successful:

- Discussion forums and fast exchange of data
- e-mail
- audio communication
- a wide range of simulations and animations

3 Individual approach to students. Orientation towards attendants (useful for education of adults), insisting on development of thinking, acquiring new skills. The basic characteristic of e-learning is a high level of individualization of teaching. This placement of students from a group in a classical classroom-where some are more quite than the others, some are faster, some make slower progress-in front of computer's monitor in their natural surroundings represents a fundamental change in philosophy of education. Psychological, didactic and methodical circumstances are absolutely different. The speed and dynamics of work are being adjusted to individuals. The same values for the quantity of information per time unit. Outer disturbance is minimal. Certainly, this is predominantly characteristic in higher education.

4 High degree of motivation for this type of teaching. In the previously mentioned research we came to confirmation of the starting sub-hypothesis according to which teaching assisted by computers causes higher degree of motivation for work.

On the ground of everything said before and on the analyses of foreign experiences several advantages of e-learning can be systematized:

- **The place and time are not important**

Distribution of data necessary for learning is significantly simplified. E-learning users (students and pupils) can approach these data from the place and in time they like, for instance: from home, school, faculty...

- **Fast adjustment of students to this type of learning**

This method gives students a chance to freely search and test their own solutions without fear of making mistakes unlike a classical way of learning with the instructor where fear is often present.

- **Consistency of data**

All the participants in the system have equal approach to data. In this way we avoid a danger of unequal approach of students to the same data. Moreover, we can be sure that all users see the material in the same way.

- **A possibility of evaluation of learning efficiency**

One of the standards of e-learning points at constant follow-up of users' achievements. This method enables a teacher to see how much time is spent on learning and by further monitoring the extent of productivity increase can be seen.

- **Reducing learning expenditure**

According to foreign organizations data (the example: Brandon-Hold.com, which evaluates success of the students who use computers in learning) this method of learning saved 40-60% in big companies. According to the research, IBM saved almost 200 million US dollars in only one year by using computers in learning.

- **Individualization of learning**

Students can learn in their own speed, dynamics and the way it suits them best. Here, students are not oppressed as in traditional method of learning with the instructor in a group where an individual has to adjust himself to the group.

- **Better remembering of contents**

According to the Research Institute of America it was established that 33 minutes after the finished course with the instructor students remembered only about 58% of the material taught during the course. Until the following day they remembered about 33% and three weeks later they remembered only 15% of the acquired knowledge. Learning in smaller groups contributes longer and better remembering of the taught material. On the other hand, while learning on computers students can remember 25-60% of the material in longer period of time.

- **Savings**

A greater quantity of remembered teaching material significantly contributes to payability of this method of learning. According to Training Magazine, companies save 50-70% by exchanging the method of learning with the help of instructors for the method which uses computers in learning.

4. Key Questions For E-Teacher

A teacher represents a key point in the process of e-teaching and success of implementing these systems depends substantially on his skill. Nowadays, teachers should be trained for their future, somewhat different role in the teaching process where they have to become creators, designers and coordinators of e-teaching.

1. *How to motivate the authors to teach their teaching material?*

E-learning brings a lot of advantages to educators. Their lectures can be seen all around the world while they may be at home, preparing new teaching material. Traditional teaching process is linked to certain time periods (start and finish of the teaching process). At e-learning time is no longer important, because distance learning can be performed at any time during the day. Similarly, the educators do not worry about the number of students in the classroom or about discipline.

2. *How to direct the users to the contents significant for their education?*

A new teaching system over hyperlinks can turn the users to the wrong way. Therefore, it is necessary to limit their moving and motivate them to go through subject matter they need, for example to pass exams. First of all, the courses offered on Internet should be evaluated pedagogically

3. *How to present contents?*

The authors will need a lot of help to present subject matter on Internet correctly. It is important to

harmonize the teaching contents to new technologies which can be really difficult both for authors and administrators of e-learning system, because apart the written material it is necessary now to find and incorporate pictures, audio records, video records, simulations... In addition, new technologies are developing so fast that constant modernization of teaching material is a must.

4. *Is there a pedagogical justification of this type of teaching?*

Tendencies to eliminate traditional frontal teaching approach in individualistic theories of e-learning have gone to another extreme: they completely neglected a social component. However, if the aim of the teaching process is a complete personality development then the conditions for a social development should be created by didactically prepared work. E-teaching gives such a possibility: to develop individuals in a social atmosphere.

5. *Which methods are to be used for creating a system of e-learning?*

Internet offers a lot of possibilities for creating a system of e-learning in the form of modern software tools. But the question is how to choose the best or at least the most appropriate one? It is necessary to find the tools that will not depend on contents acquisition or upon the possibility to get all the relevant information in the right way. That means that technical possibilities mustn't prevent students from acquiring teaching material. Within the project "A System of E-learning", at the Technical Faculty "Mihajlo Pupin" in Zrenjanin, this system is based on Internet technologies along with the use of multimedia educational software (they use ASP technology).

6. *How to evaluate students' success?*

In the pointing system it is important to harmonize evaluation in all institutions where e-learning is carried out. It is necessary to create linked systems in such a way that it is possible to get all the information about the passed exams wherever students acquire the teaching contents. In the model "Electronic Learning" the testing of students' knowledge will be carried out through tests which are adjusted to all subjects. Another problem is to check users' identity.

7. *Do users have enough pre-knowledge for e-learning?*

Readiness of users to use computers and Internet, as a means of acquiring teaching contents, must be checked. If we notice that users are not ready enough

to use computers it is necessary to train them and later give them a chance to use Internet.

8. *Where should teaching material be placed?*

The question of available equipment while installing a system of e-learning is significant to administrators of e-learning system. Another important question is the address on which to place teaching material so that the users from all over the world could access this material easily. Shortly, the key problems at creating a system of e-learning will appear in the following areas:

- a) quality of instructions and teaching contents available on Internet
- b) hidden costs
- c) abilities of creators, users and administrators

9. *Questions of standardization*

The existence of non-standard models of data, non-structured contents and incompatibility of educational platforms can cause a problem. In other words, educational contents formed in one system are completely useless in other incompatible systems. For all these reasons there is a need for standardization and evaluation of e-learning. It is a complex process which is taking place on several levels and which includes numerous aspects that should be considered. In educational process the ways for evaluation of electronic publication represent one of significant segments for successful implementation of e-learning in our country. This important process demands a lot of work and research.

5. Didactic-Metodical Questions Of E-Learning

Teachers can create the first pages for their subjects in which they can include contents, exercises, bibliography, as well as the links towards information on www, which may be useful to students. In addition, the links towards libraries and catalogues can be added. The pages related to distance learning can include discussion lists as well as forms with questions and forms for sending by e-mail.

Web pages related to distance learning should help students to find necessary information about the course, to learn material and to introduce them to the theme of the course. Web pages designed in the appropriate way should initiate thinking, discussion

and active participation during the distance learning process.

The elements related to the course which should be included on web pages are:

- information about the course and lecturer** – the name of the course, working time of the lecturer, printed material, course review, rules for evaluation
- group communication** – access to e-mail of the lecturer, discussion group for student-student communication, forms for problem reports
- tasks and tests** – distribution of tasks and tests for online filling and handing in, key review, tips and tricks, frequently asked questions
- teaching material** – lessons available in the form of web pages and files for downloading
- demonstrations, animations, video, audio** – to include material which can not be presented in classical textual format
- reference material** – a list of material in printed or electronic form which supplements text books. To avoid the copyright problems these articles should be in public ownership. In addition, the links to other Internet pages, covering this theme, can be drawn. Also, the links to similar courses available on Internet, university library and other resources which can fulfill the course (7). Internet, unlike “traditional” documents (which are mostly linear or in sequence structure), supports several ways of moving – “navigation” – through documents. By using hyper text a user can approach a document in traditional – linear way; by reading or using links within a document a user can be linked to other sites, pictures, audio files; there is also a possibility for later return to the document.

A disadvantage of the hyper text structure, despite of the fact that it offers exquisite individuality of learning, is that it may lead to users’ disorientation and overloading with information. Creators of a distance learning system (those who deal with contents) should be teachers who must have in mind the influence of hyper text structure on learning. Psychological and pedagogical reasons for using Hypertext structure are:

- increased responsibility of students directed to learning,
- control over the way the material is used or reduced,
- it is necessary to predict all possible navigator parts in order to create material that would direct users to different access to documents,

- increased need for accordance of fragmented information in order to reduce information overloading,
- increased need for multimedia elements in order to attract students' attention and to harmonize contents to different styles of learning,
- it is probable that students will not go back to the previous address after the links redirect them to another site.

Internet materials can have different characteristics from traditional sources of information:

- the contents is up-to-date and dynamic,
- the contents may be from primary source,
- the sources can be presented in various ways,
- information is manipulated easily,
- students can participate on-line,
- the contents is available for reading.

As Internet supports individual learning, the research shows that with the help of teachers this interaction increases efficiency and completes distance learning courses. Students need direction which means providing recurrent information by instructors, or a possibility to discuss problems with colleagues. Without interaction and connection to the rest of the world, distance learning is artificial and impersonal form of learning.

Modern didactic trends and the nature of modern teaching demand less frontal work, and its combination with modern forms: organizing students in pairs or individual work. Frontal form still exists but it should be modified in the future, which means that it should be used only in combination with other teaching forms. Classes should be organized by using presentations, guided teaching, self-studying and learning in groups by making projects.]

5.1. Organization Of Educational Contents For E-Learning

Preparation and publishing process of teaching material for E-learning should be organized so that it can be easily found, downloaded and used by users (students). The main problem in the process of implementing E-learning is the lack of compatibility among different platforms: courses developed for a specific system cannot be easily incorporated into similar systems of other producers. A development of contents is a task which demands a great number of supporting means. Even when they are within contents presentation (for example HTML) the adjustment of contents has to be done in order to

incorporate the contents in the new platform. In most cases the organization and delivery of contents are tightly connected to the platform's logic. Recently, several solutions for enabling contents exchange have been proposed in order to solve the mentioned problems. Standards on contents structure will make possible the appearance of authorized tools that are independent on the platform but have appropriate advantages both for suppliers and users of educational contents. In other words, in order to transfer a course from one system into the other it is necessary to transfer all elements of that course (lessons, tests, simulations...) along with "metadata". On the other hand, the structure of the starting course has to be maid on the new platform too.

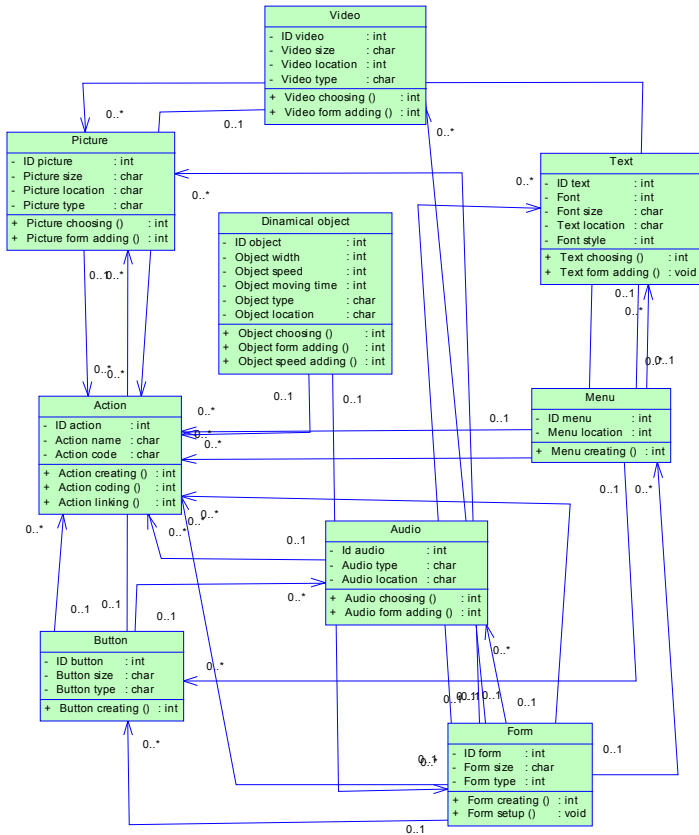
AICC board for learning aided by computers has contributed the standardization of courses structure by its Guide Lines for Interoperability [8]. According to AICC parts of courses which can be transferred in order to define a course structure are defined like structure elements. There are two types of structure elements:

- associated units, the smallest educational elements which can be presented to students (for example HTML page, simulation, test) and
- blocks which group the associated units and other blocks

There is still another element – the objective which is used to define course conditions. Associated units, blocks and objectives are the course elements. This specification is independent on the number of elements of the course structure, i.e. it is possible to add the infinite number of blocks to the structure. AICC has offered a reference structure with ten levels.

5.2. The Model Of Users' Interface For Presenting Educational Contents For E-Learning

The model of users' interface for presenting educational contents for E-learning will be presented in the following part of the paper. Class diagram is shown in the picture 2.



Picture 2

We shall pick out three linked modules which are, according to their structure, very similar:

- module for contents presentation
- module for testing knowledge
- module for help in work

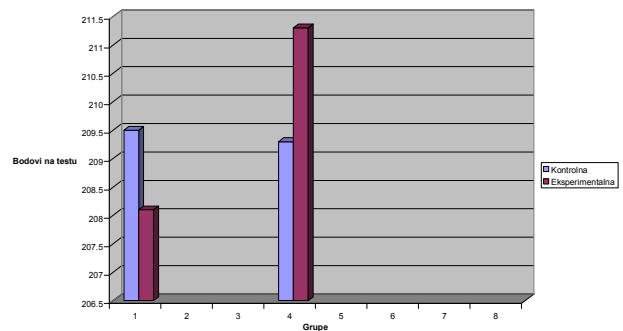
From the processes which appear in this model we would emphasize gathering process and multimedia material processing which consist of: text gathering and processing, picture gathering and processing, video records gathering and processing and audio records gathering and processing. Under these processes we separate these sub-processes as well:

- picture processing (picture processing for navigational keys, picture processing for navigational menu, background picture processing, picture processing for contents presentation, picture processing for interactive part, picture processing for knowledge testing, picture processing for additional display,
- text processing (text processing for navigational keys (hints), text processing as a hyperlink, text processing for material presenting, text processing for knowledge testing, text processing for interactive part, text processing for the help in work,

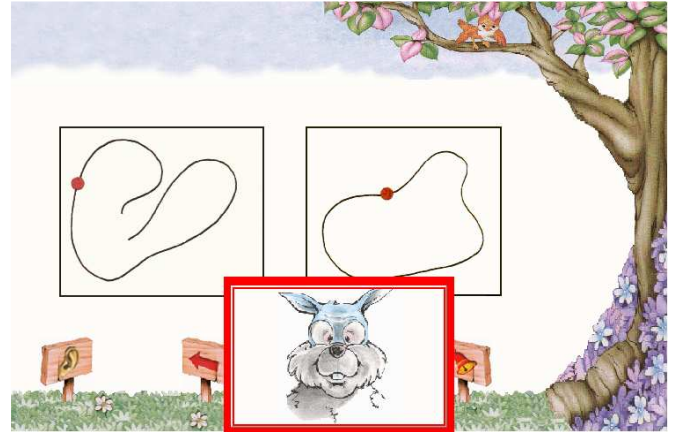
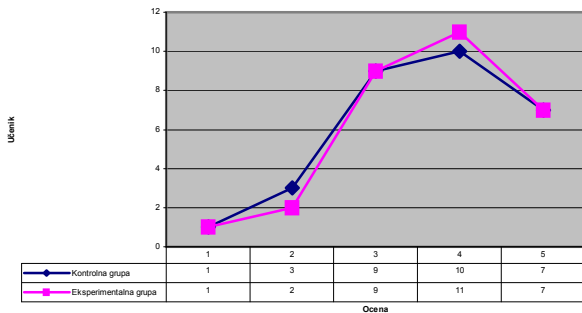
- audio records processing (audio records processing for navigational keys, background audio records processing, audio records processing for contents presenting, audio records processing for interactive part, audio records processing for knowledge testing, audio records processing for the help in work,
- video records processing (animation processing while material presenting, animation processing when testing knowledge).

6. Some Examples Of Using Computers In Teaching

There is a lot of research which has shown positive effects of using computers in teaching, especially concerning motivation and quality of acquired knowledge. One of them was a part of Doctoral thesis defended at Technical Faculty “Mihajlo Pupin” in Zrenjanin in 2005., in which motivation of students’ who assimilated a specific teaching contents by using computer software was measured. Besides, measuring of the influence of methodic innovations on increase of knowledge level and students’ abilities in the field of programming in Pascal, was carried out as well. By comparing the values of answers in control and experimental group in initial and final measuring of achievement motifs it was found out that the experimental group showed progress in the final measuring. By measuring students’ achievement motifs the results were got which showed that mid values of the answers were considerably increased in the experimental group in comparison to the control one. On the ground of these results we could make a conclusion that by implementing strategies for increasing efficiency in teaching Informatics, in which the use of computers is essential, students’ motivation for work is considerably increased:

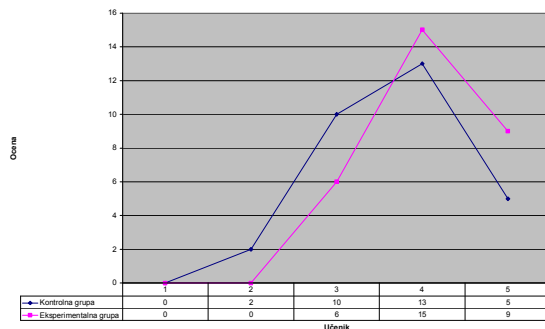


PICTURE 3: Diagram- Values of the answers in control and experimental group in initial and final achievement measuring



Educational software "Math games" for Preshool [11]

PICTURE 4: Diagram of initial empirical distribution of knowledge level



PICTURE 5: Diagram of final empirical distribution of knowledge level

Teachers or those participants in the process of e-system building who deal with designing, choose among different kinds which can be grouped in four types of basic models in organization of teaching contents.



Intro-screen of educational software "Birds" for primary school [10]

CONCLUSION

- If we want the system for electronic learning to live, educators (all those who participate in designing the system) should be aware of some key facts of teaching contents when designing modules for learning (O'Conner, 1995.):
 - designing should be a collaborative process which includes graphic designers, language instructors etc.
 - the system should be flexible enough to enable students to read material and improve their understanding of the contents
 - it is necessary to develop courses material which make possible giving recurrent information and learning in groups
 - it is necessary to use browser limits cleverly, as well as hardware and software support in order to reduce learning methods
 - advantages of outer sources of information should be accepted (for example, hyper text links)
 - Continual recurrent information is important if educators want to understand the needs and communication styles of all students. New technologies and teaching methods have improved a traditional role of teachers in the teaching process but teachers are still responsible for stimulating students' interests concerning themes and motivation in "Internet classrooms".

BIBLIOGRAPHY

- [1] <http://www.poslovniforum.hr/about02>
- [2] <http://wintel.fon.bg.ac.yu/ProgramIstrazivanja.htm>
- [3] Berlinska deklaracija o otvorenom pristupu znanstvenom znanju,
http://eprints.rclis.org/archive/00000965/01/prijevod_berlinske_deklaracije.pdf
- [4] UNICEF (2001), «Sveobuhvatna analiza sistema osnovnog obrazovanja u SRJ», Beograd
- [5] <http://www.ekonomist.co.yu/magazin/ebit/>
- [6] "What is Distance Education" by Virginia Steiner, DLRN 1995.
- [7] "Distance learning system model projecting", Mr Dragana Glušac and others, IEEE Mipro 2004
- [8] <http://www.icus.net/elearning/elearnstandards.shtml>
- [9] Slavomir Stankov, Ana Ban, "Pristupi i trendovi u standardizaciji E learning-a", Split 2004.
- [10] Vesin Ivica, diplomski rad "Ptice", mentor Dragana Glušac, TFMP Zrenjanin 2006
- [11] Dragana Glusac, „Matematika kroz igru“ softver za magistarsko istraživanje, 2000.
- [12] Dragana Glusac, „Methodical and Didactical Issues of Efficiency in Teaching Information Technology” Ph. D. thesis, 2005.