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**AN APPLICATION OF DISTANCE LEARNING AS SUPPORT FOR TRADITIONAL  
EDUCATION AT THE UNIVERSITY**  
**PRIMENA UČENJA NA DALJINU KAO PODRŠKA TRADICIONALNOM OBRAZOVANJU  
NA UNIVERZITETU**

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**ABSTRACT:** University institutions implement educational process through organization of studies, realization of education processes and providing students with the help in learning and passing exams. Information technology development gives universities the opportunity to improve their work in terms of efficiency of educational and business processes. Distance learning concept encompasses ideas regarding these changes. This paper considers an example of implementing this concept through the realization of faculty intranet and use of Internet technologies as an education process support. Student services subsystem and support to the traditional educational processes are emphasized.

**KEY WORDS:** Distance learning, traditional education, internet

**REZIME:** Visokoškolske ustanove realizuju proces studiranja organizovanjem studiranja, realizacijom nastave i pružanjem pomoći u učenju i polaganju ispita. Razvoj informacionih tehnologija daje mogućnost unapređivanja njihovog rada u smislu efikasnosti nastavnih i poslovnih procesa. Koncept učenja na daljinu objedinjuje ideje koje se tiču ovakvih promena. Ovaj rad daje primer primene ovog koncepta kroz realizaciju fakultetskog intraneta i upotrebe internet tehnologija za podršku nastavi. Posebno su obrađeni informacioni podsistem studentske službe i upotreba internet tehnologija u podršci tradicionalnom nastavnom procesu.

**KLJUČNE REČI:** Učenje na daljinu, tradicionalno obrazovanje, internet

## 1. INTRODUCTION

Within a context of rapid technological change, education system is challenged with providing increased educational opportunities, considering the use of new information technologies. Many educational institutions worldwide are answering this challenge by developing distance education programs. At its most basic level, distance education takes place when a teacher and a student are separated by physical distance, and technology (i.e., voice, video, data, and print), often in concert with face-to-face communication, and is used to bridge the instructional gap. These types of programs can provide adults with a second chance at a college education, to reach those disadvantaged by limited time, distance or physical disability. On the other hand, they can be used, just to enrich a standard teaching process.

Research comparing distance education to traditional face-to-face instruction indicates that teaching and studying at a distance can be as effective as traditional instruction, when the method and technologies used are appropriate to the instructional tasks, when there is a student-to-student interaction, and a timely teacher-to-student feedback.

Due to the nature of their work, universities have the greatest interest in including a distance learning process in their educational activities. Traditional education process can be more effective, if it is enriched with distance learning technologies. On the other hand, it provides more opportunities for the potential student who may not be limited by the time and the place of studying.

### 1.1. REALIZATION OF DISTANCE LEARNING AT UNIVERSITIES USING INTERNET TECHNOLOGIES

There is a rich history of distance education as each form of instructional media evolved, from print, through instructional television, to current interactive technologies. The earliest form of distance learning took place through correspondence courses in Europe. This was the accepted form until the middle of 20-th century, when instructional radio and television became popular. Today, there are many forms of distance education realization due to rapid technology development, especially computer and information technology. There is no doubt the Internet made a big difference in the area of human interaction, and consequently, distance learning was affected, too. Before considering the realization of distance education concept at universities using Internet technologies, we will discuss overall implications of Internet technologies on university work.

Originally, as a network of local networks, the Internet was implemented in university environment. Its first services were created by students and teaching staff. Since then, the Internet became a dominating communication medium. Therefore systematic involvement of universities in this global network is natural and necessary.

Information technologies have reached a satisfying development stage to enable realization of most of business and education activities in Internet environment. Intranet concept, as the most important technology concept for those purposes, provides secure connection with the Internet and includes advantages of Internet services, such as:

- Promoting mechanism of data exchange, which are collected at one place (or more) and are available to all users (employees, students)
- Reducing hierarchical organization structure to an interdisciplinary structure, that promotes coordinated work

- Databases access, exchange of documents and information, employee cooperation, graphic user interface
- Better communication between the education institution and students, whose studying process has been made more effective, by offering ability of getting all necessary information about studies (administrative and related to specific exams)

Although distance learning does not have to imply either student service information system development or implementing intranet concept, they have to be considered as a part of a systematic view of the problem. It means that a long-term plan of university involving the Internet has to include such a concept. Implementing the distance learning concept, which includes the integration of all university activities regarding student-university interaction, demands thorough planning and structuring, so developing an intranet is a necessity.

The Core of all faculty activities is a student service subsystem. All other subsystems rely on it. Therefore, the second section of this paper presents the implementation of Intranet, where the student services subsystem is emphasized.

The forth and the fifth sections are related to the use of Internet technologies in the education process. Examples of using the Internet as a support to the realization of courses of:

- Operating systems and concurrent programming at the Faculty of Science in Kragujevac
- Simulation and simulation languages, Simulation in business decision making, Simulation, Methodology of developing information systems, Information Systems and Concurrent Programming at the Faculty of Organizational Sciences in Belgrade

## 2. INTRANET - AN OPEN LEARNING ENVIRONMENT

Many institutions and companies implement Internet technologies in their organizations. Almost all institutions and companies base their activities on already existing information systems in local networks. The problem is how to make a secure connection of those systems to the Internet, i.e. how to be protected from "breaking in". In order to solve this problem, the concept of Intranet has been brought. Intranet uses the Internet technologies and connects different systems and platforms, where the Internet is separated from a private network by a security system. These internal networks enable organizations to:

- centralize information
- organize information
- reduce costs and increase efficiency
- promote sharing of information
- accelerate the development and distribution of applications
- organize presentation using Web sites

Universities were among the first organizations that applied Intranet technologies. Institutions of this kind have considerable information resources, which are very useful for employees in administration, student services, for teachers and students. The reasons for which a university should implement databases into the Intranet are:

- The ability to browse a great collection of data easily in

order to find relevant information.

- The possibility of changing, adding or updating databases from more than one location.
- Giving on-time and dynamic data in an easy, quick and modern way to all users.
- Connecting databases to Intranet is the most important decision, which is brought in order to promote and enlarge functionality of the internal network. Most of information is found in databases. These databases can be situated at one place, but most commonly they are scattered across the whole Intranet.

Internet services used in building an Intranet enrich its functions, for instance:

- HTML pages give the opportunity of insight to every user who owns a search engine.
- FTP protocol provides quick transfer of files from the server to the user computer.
- Telnet is a service that provides access to remote computers and use of programs and services available on these computers.
- Electronic mail provides an exchange of messages in a quick and easy way.
- Intranet also offers the possibility of real-time conversations in programs like IRC or ICQ.
- Message board represents another means of communication between users.

With the increased popularity of the Internet, a serious problem related to the security of networks arose. Firewall is a combination of hardware and software that provides Intranet users with an access to the Internet, but prevents an unauthorized break-in from the Internet. Routers, proxy servers, bastion servers etc may provide an additional protection.

When we talk about a university Intranet, the starting point is analyzing its information system. Globally, a university includes the following information subsystems:

- Information subsystem for scientific research
- Business information subsystem (student services)
- Information subsystem for the education process
- Library information subsystem
- Information subsystem for financial, accounting and administrative activities

Although all subsystems represent separate complete units, there is more or less overlapping between them. Information systems in an education process are shown in connection with a business information system of a faculty. This section of the paper considers a business information system only, as the most important of all systems. The business information system of a faculty includes the following processes:

- Entering test
- Lectures and exercises organization
- Term admission
- Term verification
- Applying for tests
- Taking tests
- Graduation

- Issue of certificates
- Statistical analysis and reports
- Postgraduate studies

Data flow diagram of a business information system of a faculty is shown on fig. 1.

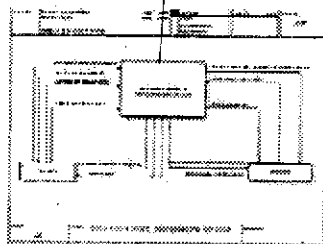


Fig. 1. Data flow diagram

### 1. Admission test

This process begins with announcing a competition, which actually means defining documents required for applying for the studies at the Faculty, defining the admission conditions and deadlines for all activities. In the process of admission, the following is to be determined:

- Completeness of the documents
- Taking tests organization
- Listing and publishing the results

Candidates who pass the admission test fulfill the conditions for enrollment at the faculty, or to the first term.

### 2. Lectures and exercises organization

Lectures and exercises organization means making groups, appointing teachers and assistants as well as making lectures and exercise timetable.

### 3. Term admission

For term admission an application form is needed. If a student wants to be admitted to a certain term, he must meet some conditions required by the faculty statute. For entering fall terms, which means entering a year, certain conditions must be fulfilled:

- Passing a required number of exams from a current year as well as from the previous ones
- Checking if the financial obligations are fulfilled by scholarship-paying students
- Checking other special and specific conditions for entering a term or year
- Checking if the previous term is verified

### 4. Term verification

For verifying a term, a student gives a term form and student's booklet. It must also be checked whether a student has been admitted to the term that is being verified.

### 5. Applying for tests

A document called test application form is needed for applying for a test, and its contents must be transferred to a database. Before a test application form becomes valid, conditions for taking a test must be checked. This check includes the control of the following conditions:

- Whether a student attended the lectures
- Whether the last term that includes the subject is verified

- Whether the obligatory subjects are passed
- How many times the student took a test
- Specific checks

### 6. Taking the tests

Results of taking the tests are entered into the test list. For the test, which students have passed, all test application forms are deleted and the mark received is updated into the database.

### 7. Graduation

A student can graduate when he/she

- passes the graduation exam, or
- passes the last exam.

The names of graduated students are put in special tables, and their data are deleted from the tables where the names of undergraduate students are.

### 8. Postgraduate studies

Postgraduate studies are divided into several areas and have the same concepts applied to the undergraduate studies. Postgraduate studies include: admission to postgraduate studies, term enrollment and verifying, applying for and taking tests, issuing certificates and statistics.

### 9. Issue of certificates

Issue of certificates is done on a student's demand, and every certificate is issued for special purposes: a student's status and a year or term enrollment certificate, the number of passed exams and an average mark certificate, a graduation certificate, etc.

### 10. Statistical analysis and reports

Statistical analysis and reports are very common at universities. Some of them may be considered standard, and others are ad hoc queries. The database conception allows queries for various demands.

## 3. THE INTERNET AS AN EDUCATIONAL MEDIUM

If we speak about the quality of the Internet as an educational media, it would basically refer to the advantages of technical features. Since it is based on network and information technologies, it provides:

- that location and time of acquisition of knowledge are independent of course materials
- simultaneous serving of the great number of users
- realization of information/program archive by using distributed information systems

The Internet can be used as basic or additional means in the realization of the studies, meaning that there are two concepts of its application:

• *full implementation of distance learning concept*, which is basically developed inside the University, called "Virtual University", and it includes the realization of all administration and educational activities of an educational institution in the Internet environment

• *support to the traditional educational process*, where services are used only to help, instead of being the basic work and education environment

In addition to all stated above, it is important to stress that

an education support system should not be viewed separately from the already described working concept of Intranet. It is just a part of an overall direction of the university activities toward the work in the Internet environment. From the aspect of technical realization, it should be placed on one of the Internet servers, which is a part of Intranet network.

In the next two subsections of this paper, a theoretical consideration of the use of Internet technologies as support to education process is given.

### 3.1 INTERNET AS SUPPORT FOR TRADITIONAL EDUCATION PROCESSES

The Internet, as a global computer network, provides different forms of communication between the student's themselves, between the students and the teacher, and provides their access to the source of information all over the world. Its services provide:

- the contact between the teacher and students by *e-mail*

*E-mail* is extremely popular because of its simple use and its advantages in communication. The students need the contact with the teachers, in order to get information related to the course. It is important that *e-mail* system should be widely used and become the way in which communication between a teacher and a student is carried.

- the exchange of materials using *FTP*

This service gives the opportunity to transfer the test materials (literature, papers, software), regardless of their size. This opportunity exists in *e-mail* services as well, but the size of the files, which can be sent, is limited.

- searching the databases using *Gopher* or some other specialized search engine

- *on-line* communication using *IRC*

Using *IRC*, the student can talk to the teacher in real time, and, by this, get answers to the questions that he needs immediately

- conferencing on different topics inside the *News* groups

*News* service provides an *off-line* message exchange between the greater numbers of participants. Students can join the groups with different subjects, ask questions and give answers to all group members.

- creating course *Web* site, including lectures, materials and the tests

The course is the central part of the learning support system. The presentation offers the most important data and information related to the course or the subject, and it is available to the students at any moment. The students use the site to achieve new knowledge. It should provide active learning, learning time reduction and it should improve motivation.

#### 3.1.1 CREATING A COURSE PRESENTATION

Creating a presentation is an important and complex task, which demands involving a great number of participants. Creation of the site depends on the needs of users. It is important that it should fulfill all their needs in the knowledge-acquiring area.

During the creation of the site, which will be used as a support to the traditional education process, the following should be considered:

- the work on the creation of the site should be divided, and the students should be engaged and liable for the part they work on

- the teachers should be encouraged to transfer the experience and knowledge they have and which is related to the education process, to the web, with the additions and services offered by the Internet

- all necessary material, literature, software, examples should be placed on the site, and the use of *FTP* service should be provided

- data search through the site should be easy

- the contact between the teachers and students should be provided by using *mail* service

- the information related to the subject and the test should be up-dated

- place *FAQ* in order to provide the students with the quick answers related to the course

- the link numbers toward the other institutions or sites with the similar contents should be limited, and only those which can be useful to the students should be chosen

- the presentation should be updated regularly

A good site should provide an easy navigation, which means that: the path through the course materials is clearly and precisely marked; easy moving through the presentation is provided, which will satisfy the needs of those that attend the course; searching should be encouraged and the student should be able to return to the place where he was working before.

#### 3.1.2 FURTHER STEP - INTELLIGENT TUTORS ON THE WEB

From the very early days of World-Wide Web there were multiple efforts to use WWW facilities for distance learning. At the same time most of existing educational WWW applications use the simplest solutions. A number of powerful technologies, which prove to be very effective for 'on-site' education, are still not implemented within the WWW framework. One of these technologies is Intelligent Tutoring Systems (ITS) technology, with the purpose to support flexible individualized learning and tutoring.

Intelligent Tutoring Systems (ITS) are computer-based software packages, which use the techniques discovered in Artificial Intelligence research to aid the teaching of some subject or skill. The goal of ITS is to provide the benefits of one-on-one instruction automatically and cost-effectively. Like training simulations, ITS enables participants to practice their skills by carrying out tasks within highly interactive learning environments. However, ITS goes beyond training simulations by answering user questions and providing individualized guidance. ITS systems assess each learner's actions within these interactive environments and develop a model of their knowledge, skills, and expertise. Based on the learner model, intelligent tutoring systems tailor instructional strategies, in

terms of both the content and style, and provide explanations, hints, examples, demonstrations, and practice problems as needed.

Intelligent Tutoring Systems are built on fairly well established architecture, which relies on four interconnected software modules: the Expert Module, the Student Module, Curriculum (Pedagogical) Module, and the Environment (Interface) Module.

- The **Expert Module** contains information about the subject knowledge domain, such as the facts and concepts being taught and the processes needed to complete problems within the system. The Expert Module may be thought of as manipulating a data structure called an Expert Model, a dynamic vision of the knowledge domain.

- The **Student Module** contains information about the student's understanding of the knowledge domain. It does this by having a model of how students learn and using diagnostic tools contained within the Curriculum Module to extract the learner's knowledge state about the subject.

- The **Pedagogical Module** contains rules or other decision making tools that allow it to judge how well the student's understanding of the subject domain (as represented by the Student Model) matches actual knowledge structure (as represented by the Expert Model). It may then generate correct forms of instruction or remediation to give to the Interface Module.

- The **Interface Module** presents the user with a uniform environment within which instruction, diagnosis, remediation, and user driven learning may take place.

The structure stated above is common and its variants are determined by the type of the domain knowledge and purpose of the system (knowledge evaluation, learning, training etc).

Although there are many types of Intelligent Tutoring Systems around, each one must behave intelligently. They must be able to:

- accurately diagnose students' knowledge structures, skills, and styles
- diagnose using principles, rather than preprogrammed responses
  - decide what to do next
  - adapt instruction accordingly
  - provide feedback

Currently, web-based educational systems are a challenging research and developing area. Benefits of web-based education are the independence between teaching and learning with respect to time and space. Courseware installed and maintained in one place may be used by a huge number of users all over the world. With the WWW as an educational platform, it will be feasible for the students to access the multimedia courseware with general-purpose browsers. No special tools are required to start learning. For the courseware provider, it is not necessary to worry about the distribution and maintenance of the copies of the courseware but they just take care of the original on their server.

Building an intelligent tutor is a complex task. On the other hand, porting such a system to the web is another problem,

which can affect the system's architecture. Several architectures for Web-enabled tutors have emerged so far. If we consider the location at which the tutoring functions are performed, three types of architectures emerge: centralized, replicated and distributed.

1. In the **centralized architecture**, the Web and application servers run on the server side, while the student interface is displayed in a Web browser on the client's machine. The application server performs all tutoring functions. The student interacts with HTML entry forms, and the information is sent to the Web server, which passes the student's requests and actions to the application server.

2. In the **replicated architecture**, the entire tutor resides in a Java applet that needs to be downloaded and is executed on the student's machine. All tutoring functions are therefore performed on the client's machine, while the server is only used as a repository of software to be downloaded.

3. In the **distributed architecture**, tutoring functions are distributed between the client and the server. The exact policy on distributing the functions may vary. Most often, the application server consists of a student modeler, a domain module, and a pedagogical module.

#### 4. AN EXAMPLE OF THE WEB BASED PROGRAM FOR DISTANCE LEARNING OF MATHEMATICS

Presented methodology for efficient teaching process, supported by Internet services is applied to web based program for distance learning of mathematics, for students of the College of Electrical Engineering.

The developed system in the Internet environment has the tools for automatic checking of the level of acquisition knowledge and decision about the next step of training based on the previous results with the aim of optimal way of completing teaching courses.

The developed Web application for Internet teaching demonstrates the possibility of application of Internet technology for high school mathematics teaching. In this way the students will be able to test the accepted or to obtain additional knowledge from any place where the Internet is accessible.

Teacher defines the fields of mathematics to categorize exercises, and then defines mathematical problems to be solved. The students can solve problems applying Web application in two ways: online learning or on line self-testing. The learning process offers help by additional material (examples, definitions, explanations) or giving students the direction of the next step in learning. The program observes the students learning process increasing the problems complexity and difficulty if the learning process is successful and decreasing it in the opposite case. Testing enables the student to test himself alone.

The students can monitor their progress by the history of the learning process and statistical reports. The teachers have also the possibility of inspection of the students activities. The new way of communication between teachers and students or mutual communication between students is possible by way of dialogues.

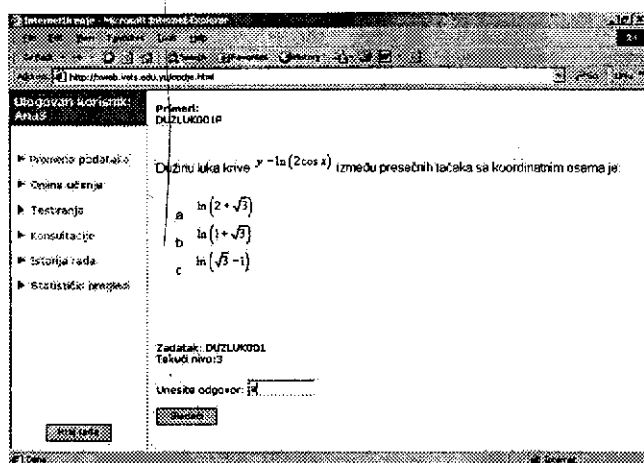


Fig. 2. An example from the distance learning program

#### 4. 1 STATISTICAL RESULTS OVERVIEW AFTER APPLICATION OF THE PROGRAM FOR DISTANCE LEARNING OF MATHEMATICS

Now let us describe the students' achievements compared with the traditional method of teaching Mathematics.

The program for long distance learning of mathematics in real school system of the College of Electrical Engineering is tested. The following items were analyzed:

- The program functionality,
- The acceptance of the program by students,
- The efficiency of the knowledge acquisition,
- The frequency of backward steps in the case of unsuccessful knowledge acquisition.

During the program testing students were given a questionnaire with the aim to inquire about their impressions and suggestions about the long distance learning program. The program improvement based on student suggestions was realized. These improvements were possible to realize only in the case of real program application on the students population for which the program is designed.

The student's response to the long distance learning by using this program as a support to the traditional Mathematics learning is of essential importance due to the lack of experience in this area. This kind of learning is for the first time applied in the field of mathematics in our country.

The program is tested on the sample of 126 students of the second semester of the first year of studying the field of New Information Technologies at the College of Electrical Engineering in Belgrade.

The program is applied to the following subjects:

- Engineering mathematics (sample of 126 students),
- Numerical mathematics (sample of 126 students).

The students are tested in the software MatLab application in traditional way and with the program for long distance learning combined with the traditional method. The results of the comparative analyses are presented in figures 4.1.

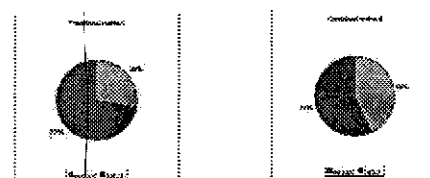


Fig 3. The success in the written test of numerical analyses when only traditional and combined method was applied

From figure 3. It can be concluded that the student tests results are significantly improved when the combined method was applied compared to the case of traditional method

In figure 4. The comparative analyses of the student's success when learning MatLab by the traditional method and by the combined traditional and long distance method are displayed.

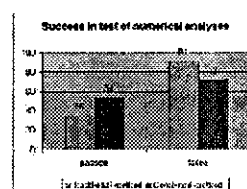


Fig 4. The comparative analyses of the student success in the written test of numerical analyses when only traditional and combined method was applied

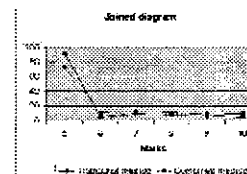


Fig 5. The comparative analyses of the student marks in the written test of numerical analyses when only traditional and combined method was applied (5-failed, 10-excellent)

It can be concluded that the application of the combined method of learning Mathematics significantly improves the students learning efficiency and the quality of the acquired knowledge.

#### 5. CONCLUSION

Today, education system is challenged with providing increased educational opportunities, considering the use of new information technologies. Many educational institutions all over the world are answering this challenge by developing distance education programs. Owing to its possibilities the Internet represents a powerful means and a great environment for distance learning realization. The Internet became a dominating communication medium and a significant part of everyone's life so the participation of universities in this global network is natural and necessary. Its activities must be directed towards the work in the Internet environment. There are two basic groups of activities whose realization should be considered in that

respect: organizing the studies and realization of education processes. In order to fulfill these processes technologies that provide both security and efficiency in information exchange are needed. Intranet technology concept is the answer. Intranet gives good background for data exchange and effective communication. Providing secure access to databases from the outside, e.g. the Internet, with graphic user interface, improves communication between the Faculty and the students, whose studying is made easier. First, they are offered the possibility to reach the information related to the studies, like the information about the studies curriculum, the passed exams, taking tests schedules, the test results, possibility to apply for the exams through the Internet. Secondly, by the support to the education process, through giving all the necessary information related to the exam and possibility of communication with the teacher using different services, preparing and taking the exams is made easier for students.

Therefore, Intranet presents good and complete surroundings for realization of distance learning concept in the university environment using Internet technologies.

#### REFERENCES

- David Garrett Jerry Ablan Eric Ashman Josh Becker, *Intranets Unleashed*, Indianapolis, Indiana, Sams.net Publishing, 1997.
- Eugene Eric Kim, *CGI Developer's Guide*, Indianapolis, Indiana, Sams.net Publishing, 1998.
- Ivković M., Radenković B., *Internet i savremeno poslovanje*, Tehnički fakultet "Mihajlo Pupin", Zrenjanin, 1998.
- Jill H. Ellsworth, Ph.D., Billy Barron, John December, William R. Stanek, *Internet Unleashed*, Indianapolis, Indiana, Sams.net Publishing, 1998.
- Jon DeVaan, *Microsoft Office Resource Kit*, Microsoft Corporation, November 1999.
- Preston Gralla, *How Intranets Works*, Macmillan Computer Publishing USA, 1998.
- Scott Zimmerman and Tim Evans, *Building an Intranet with Windows NT*, Indianapolis, Indiana, Sams.net Publishing, 1999.
- Virginia Andersen, *Access 2000 Complete Reference*, Osborne, McGraw-Hill Companies, 1999.
- Weiyang Chen, Sanjaya Hettihewa, Arthur Knowles, Paolo Pappalardo, *Designing and Implementing Microsoft Internet Information Server*, Indianapolis, Indiana, Sams.net Publishing, 1999.
- Korunović D., Cvetanović S., *Informacioni sistem preduzeća u intranet okruženju*, Internet i savremeno poslovanje, Beograd, 1999.
- Filipović D., *Obrazovanje i razvoj*, Beograd, KIZ "Kultura", 1998.
- Maulsby D., Witten I. H., *Teaching Agents to Learn: from User Study to Implementation*, Computer, Volume 30, Number 11, November 1997.
- Davies G., *Teleteaching, Distance Learning, Training and education*, Preceding of the XV IFIP World Computer Congress, Wien, Budapest, 1998.
- Popović M., *Poslovno obrazovanje uz korišćenje savremenih informacionih tehnologija*, diplomski rad, FON, Beograd, 1999.
- Kaplarević A., Milošević S., Radenković B., Vujić V., *Intranet tehnologije u obrazovnom procesu*, Info science 1-2, 2000.
- Milosavljević G., *Programiranje obrazovanja za računar*, FON, Beograd, 1995.
- Milosavljević G., Vukanović S., *Profesionalno obrazovanje na distancu*, FON, Beograd, 2000.
- Kutlača Đ., *Informacione tehnologije u obrazovnom sistemu: izazov i potreba, rizik i investicija u budućnost*, INFO 3/97, FON, Beograd, 1997.
- Stefanović D., Parezanović D., Kaplarević A., *An Internet Environment for Business and Educational Activities of Universities*, Management 44-51, Beograd, 2000.



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