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Analytical Survey

**"THE EXPERIENCE OF INTERNET
USAGE IN EDUCATION"**

Moscow
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“THE EXPERIENCE OF INTERNET USAGE IN EDUCATION”

Analytical Survey

This analytical survey has been prepared for the United Nations Educational, Scientific and Cultural Organization (UNESCO) in accordance with the contract with the UNESCO Institute for Information Technologies in Education (IITE) by the specialists of the Corporation “University Knowledge Networks” (UNICOR) (Moscow, Russian Federation).

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ABSTRACT

The UNESCO Institute for Information Technologies in Education (IITE) initiated and began in 1999 the fulfilment of the project "Internet in Education". The goal of the project is to research the current state of the problems in the use of the Internet in Education and the development on this basis of an information system, whilst accumulating data in the domain. This work is conducted within the framework of the collaborative project with CII UNESCO Sector (29/C5, 04045) and in co-operation with "University Knowledge Networks" corporation (UNICOR, Russia).

One of the first stages of this project was the preparation of the analytical survey "The Experience of Internet Usage in education" (V. Verzbitsky, A. Gusev, V. Krasnov, A. Khannanov, D. Yanson). An analysis of about 90 works, published in recent years by the leading researchers and practising teachers from different countries, was conducted in the survey. The data from scientific researches, statistical reports, national and international organisation's reports were used. To evaluate the current situation in accumulating, analysis, exchange and distribution of essential education information on the Internet, more than 30 universal and 70 specialised information systems in education on the WWW were examined.

The information gathered thoroughly characterises the situation in the sphere of Internet use in education. The survey presents:

- typologies of the types of Internet Applications in Education, constituting an exhaustive list;
- descriptions of the Internet-technologies, used in education;
- statistical data of the particular Internet-applications distribution in different countries, taking into account social and age groupings;
- explicit presentation of the achievements and problems of the Internet use in education, systematised according to various types of educational activity. At the same time the corresponding achievements and problems in teaching/learning as well as in the organisation and management of particular educational institutions and educational systems at different levels were considered.
- a database of 100 Information Systems in Education (ISE's) on the Web, which is illustrated by a series of tables and diagrams and is itself valuable for anyone who wants to find educational information on the Internet.

Analysis, evaluations and recommendations. The systematisation of the initially, scattered data allowed the researchers to conduct an initial *analysis of the situation in the educational Internet*. For example, it was found that usually only 2-3 of 20 currently known Internet-applications is used in the majority of educational institutions. Besides, the cause of such a situation is a lack of information rather than a lack of financing.

It was shown that the use of the Internet in the sphere of organisation and management of education leads to the growth of economical efficiency of educational institution's activity and to the increase of education accessibility on a global scale, despite a whole set of problems reviewed in the survey.

The research showed both general and less obvious *developments in the use of the Internet for education*. This allows policy and decision makers to use the survey as an information base for the prediction of situations

and for making decisions concerning policy for the computerisation of education. Particularly, the transition from technologically oriented Internet use in education to the focus on educational tasks clearly manifested itself.

Special attention was devoted to such positive developments and tendencies, that may become critically important for *overcoming* accumulated *problems in Internet use in education*. For example, a very effective way to solve one of the most important problems—lack of qualified personnel for teaching on the Net is to prepare specialists via “professional networking”. Undoubtedly, the Internet reflects differences in social-economical development in the North and the South, the West and the East. At the same time it provides technical, organisational and informational capabilities to reduce this gap by information exchange in educational sphere, and these capabilities are far above any traditional technologies.

During the preparation of the survey a database of ISE's was created to evaluate the current mechanisms of accumulation and exchange of information and to develop *recommendations to administrators, teachers and learners concerning the search for educational information on the Net*. This is not just one of the most complete ISE catalogues on the Internet, but a detailed description of peculiarities of a great number of ISE's including an analysis of their functional capabilities.

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ANALYTICAL SURVEY “THE EXPERIENCE OF INTERNET USAGE IN EDUCATION”

1. INTRODUCTION

1.1. Objectives of research

In 1990s the development of the Internet has become a factor of global significance. The importance of the usage of the resources and technologies of the Internet in education is obvious today. All developed countries of the world have more or less extensive programmes of the Internet development in the sphere of education. The overwhelming majority of the developing countries, despite the still existing difficulties, problems and fears, in accordance with their possibilities seek to take part in the formation of the global educational community. In doing so, the systematisation and analysis of the experience of Internet usage in education becomes an urgent problem for each country and the global community as a whole, regarding benefits, as well as obstacles and undesirable consequences.

Taking the huge scale of the Internet into account, the creation of the mechanisms designed for effective navigation of the Internet, accumulation, analysis, exchange and distribution of the information important for education, which would comply with the requirements of various categories of users, acquire greater importance. The usage of the Internet in the education field acquires greater importance as well. However, according to the results of the research, despite the outstanding progress made in some countries in the creation of universal information retrieval systems and specialised information systems on the problems of education. Neither of such systems taken separately can provide a complete service. At the same time, a powerful tool for the solution of problems arising can be provided on the basis of the co-operation between such systems. The specialised information system “Education via the Internet”, offered for development within the framework of the UNESCO program activity, may become one of a group of permanent international tools of co-operation.

This work includes the analytical survey of the experience of Internet usage in education and Terms of Reference on the development of the specialised information system “Education via the Internet”. This system is designed to accomplish the following objectives:

- to systematise the information on the study of the experience of the Internet usage in education conducted during the last 3–5 years, and give brief description of the main achievements, problems and tendencies;
- to analyse the opportunities for meeting main information requirements in the sphere of education provided by the existing information systems on the Internet;
- to substantiate the necessity of the establishment of the international information system “Education via the Internet” (ISEI) from the point of view of the objectives in the sphere of education pursued by UNESCO.
- to create a conceptual framework (which shall imply that an area of responsibility and a range of functional tasks should be identified) of the produced information system so as to organise an international collective of developers which would jointly work on the basis of such a framework.

1.2. Adopted terminological agreements and abbreviations

For the purposes of this survey the following terminological agreements and abbreviations shall be adopted:

"Internet (Net)"—the electronic communication environment built on the basis of the worldwide computer network.

"Internet-technologies"—the complex of hardware and software means providing Internet operation.

"Education"—activities involving teaching, learning, management and administration.

"Application of the Internet in Education (AIE)"—the type of educational activities based on Internet-technologies.

"Information System (IS)"—the structured database accessible via the Internet, which in some cases provides extra services (e.g. searching and analysing).

"ISE"—"IS on education"—the specialised information system on education oriented towards educational problems.

"IRS"—an information retrieval system.

"DE"—distance education.

"ISEI"—the information system referred to as "Education via Internet".

1.3. Data acquisition methods.

The literature for the survey was mostly searched on the Internet. As the result of searching, more than 80 works of different types were selected—statistical reports made by governmental bodies and international organisations, reports of research institutions and monographs of individual scientists, conference proceedings. English and Russian language sources only were used according to the contract.

31 universal and 72 specialised information systems were found and analysed in the course of searching, during which different strategies and methods of search on the Internet were used as an empirical structure to select possible analogues for creating the system and (or) integrating it with them. All Internet hyperlinks (URLs) in the survey were revised on March 23, 1999.

2. THE EXPERIENCE OF INTERNET USAGE IN EDUCATION

2.1. Existing typologies of Internet applications in education

The application of the Internet in education is understood as the usage of various Internet-technologies for the solution of various educational tasks, namely, teaching, learning and management of the educational process. The systematic analysis of experiences in using the Internet in education implies that the types of such application provide an opportunity for comparisons and generalisations that can be preliminarily identified and defined. In doing so, depending on a chosen typology, the analysis will cover various aspects of the experience.

Various typologies of the Internet Applications in Education (IAE) have been proposed in the literature in recent years. At the same time, it should be noted that due to the accumulation of experience in the use of the telecommunication technologies in education, two approaches to the selection of grounds for segmentation of this project-domain have been revealed.

The technology-oriented approach is most widespread. For example, the statistical research on the use of the electronic communication in open learning and distance education, conducted by UNESCO in 1995 (Euler, Berg, 1998), has used the following matrix based on **the types of the applied telecommunication media** for collection of information on interactive technologies in educational programmes:

- 1) telephone;
- 2) fax;
- 3) audio-conference;
- 4) video-conference;
- 5) electronic mail;
- 6) access to databases.

Under such approaches towards the research of the experience of AIE, the analysis of technical equipment and the readiness of the participants of the educational process to use respective technologies prevail. Such an approach may also be modified. An example of modification may be the typologies based on **the level of the equipment in educational institutions** or the **skills level** of the teachers and learners in computer and telecommunication tools use. For example, P. Groves with co-authors (Groves, Lee, Stephens, 1997) describes the following types of IAE:

Table 1

Internet tools for on-line teaching by Groves, Lee, Stephens, 1997

Virtuality degree (skills level)	Internet tools
Low level	Usage of e-mail or discussion lists
Medium level	Discussion lists and online lecture notes delivered via the Web
High level	The above plus interactive Web tutorials, designed specifically for the course and student interaction (e.g. production of their own Web-pages)
Expert level	The above plus virtual environments, giving the participants possibility of co-operative activity (like Multi User Dimension, MUD)

On the other hand, one can single out the group of typologies of Internet applications based on the principles, which do not tie the IAE down to some particular (but continuously developing) computer and telecommunication technologies. These typologies are oriented towards the analysis of the parameters characterising the solution of the educational problems proper.

So, J. Ellsworth (Ellsworth, 1998) proposes the classification of the Internet tools in accordance with **the types of interaction between the participants of the educational process** in the course of solution of different tasks /Net tools with different combinations of students, teachers, and curriculum goals:

- 1) interaction between the students and professors in educational process;
- 2) interaction between the students and professors during information searches on the Net;
- 3) professional joint activities of professors and administration;
- 4) students' joint research projects.

J. Harris (Harris, 1995), analysing the experience of successful design and implementation of online education courses and applications, introduces a notion of "activity structures" which means a model of activity of participants of educational process in the Net. Divided, in accordance with **the types of interaction**, into three big parts, "activity structures", by Harris, form the following typologies:

Kinds of interaction	Activity structures
Interpersonal interaction	<ul style="list-style-type: none"> • key pals • global classrooms • electronic appearances • electronic mentoring • impersonations
Information collection	<ul style="list-style-type: none"> • information exchanges • database creation • electronic publishing • tele-fieldtrips • pooled data analysis
Problem-Solving Projects	<ul style="list-style-type: none"> • information searches • parallel problem-solving • electronic process writing • serials creations • simulation • social action projects

One of the possible approaches was proposed by L. Harasim (Harasim, 1989), M. Rapaport (Rapaport, 1991) and developed in the sphere of education by M. Paulsen (Paulsen, 1995, 1998). Paulsen proposes that the following four **types of communication paradigms** (communication methods) **and the kinds of "pedagogical techniques"** should be taken into consideration as a basis for singling out different Internet applications. He suggests that these "pedagogical techniques" should be interpreted as "the ways of accomplishing teaching objectives". In a summarised form this typology is presented as follows:

Table 2

Methods, techniques and devices that could be applied in CMC-based teaching systems
(Paulsen, 1995, 1998)

Ways of communication	Single	One-to-one	One-to-multipitude	Multipitude-to-multipitude
Pedagogical techniques	<ul style="list-style-type: none"> · Online databases · Online magazines · Online applications · Program libraries · Online hobby groups · Interview 	<ul style="list-style-type: none"> · Educational contracts · Preparation courses · Internship · Correspondence teaching 	<ul style="list-style-type: none"> · Lectures · Symposiums · Publications 	<ul style="list-style-type: none"> · Discussions · Simulations or games · Role-playing · Case-studies · Discussion groups · Transcript-based assignments · Brain-storming · Delphi-technique · Nominal groups techniques · Forums · Project groups
Types of CMC-devices	Facilities for work with online resources	E-mail	Listservers, BBS and WWW	Usenet, BBS and computer teleconferences

Based on the opportunities provided by the Internet for de-monopolisation of information sources and estimation during the teaching process (due to the overcoming of time restraints) of individual learning styles of each student, and proceeding from the thesis of M. Knowles (Knowles, 1991) about the necessity to apply more diverse **teaching methods** in this context, T. Pitt (Pitt, 1996, Pitt & Lark, 1998) gives the description of the ten "online teaching strategies":

1. Educational contracts.
2. Lecture.
3. Discussion.
4. Self-teaching.
5. Tutorship.
6. Work in small groups.
7. Project method.
8. Case-study.
9. Forum.

In the end, J. Davies (Davies, 1997) builds her own typology of the usage of the Internet in education on the basis of **the activity types** in all aspects of the educational process (see Table 3).

It is easy to notice that the latter four of the above-considered classifications are compatible since they are based on the supposition that educational tasks shall be primary ones in the usage of new information and telecommunication technologies. A similar approach became predominant recently. According to A. Barron and G. Orwig (Barron & Orwig, 1997), "the objectives and tasks of teaching shall be the first to be determined, and only after that, particular technologies for their achievement should be selected". The technological resources must comply with the curriculum, not vice versa.

IAE typology according to Davies, 1997

1.	Web-Based Courses	<ul style="list-style-type: none"> · Fully WWW placed courses · Major components of the course in WWW · Support in WWW · WWW contains only the information on the course
2.	Educational Administration	<ul style="list-style-type: none"> · On-line admission · Courses registration · Tuition payment · Administrative tasks
3.	Development of Communication Skills	<ul style="list-style-type: none"> · Thematic student-to-student correspondence, including students from abroad
4.	Electronic Publishing	<ul style="list-style-type: none"> · Creating of hypermedia Web-pages by students · Issuing of on-line journals
5.	Mining Information	<ul style="list-style-type: none"> · Databases browsing · Electronic encyclopaedias
6.	Ask the Experts	<ul style="list-style-type: none"> · E-mailing questions to the most famous experts
7.	Electronic Appearances & virtual realisations	<ul style="list-style-type: none"> · Virtual conferences or forums
8.	Simulations	<ul style="list-style-type: none"> · MUD, MOO
9.	Involvement in Research Projects	<ul style="list-style-type: none"> · Shared global search, collection and analysis of information
10.	Professional networking	<ul style="list-style-type: none"> · Exchange of experience and information via synchronous and asynchronous teleconferencing and discussion lists

R. Petersson (Petersson, 1989) points out that the technology should serve the contents and methods of teaching. At the same time, the same technology can be used for different types of educational activity.

2.2. Applied technologies

The level of Internet technology usage differs in various countries. Still, the data from the research conducted by the Internet Society allows for the assumption that there is a technological ground for a drastic increase in the intensity of the international information exchange (maps presented on Fig. 1 are based on the analysis of the dynamics of obtaining Internet access of different types in 1996 and 1997).

The literature contains incomplete data on the application of Internet-technologies in separate countries, at separate educational levels and at specific educational institutions.

It is important to note that for achieving the objectives of this survey, it is necessary to select the typological functions of the application of information and telecommunication tools in education. This can be adequately accomplished by the notion of Internet-technologies alone. Therefore, particular software tools (the number of which, compared to the number of Internet-technologies, is large enough), applied in education, are

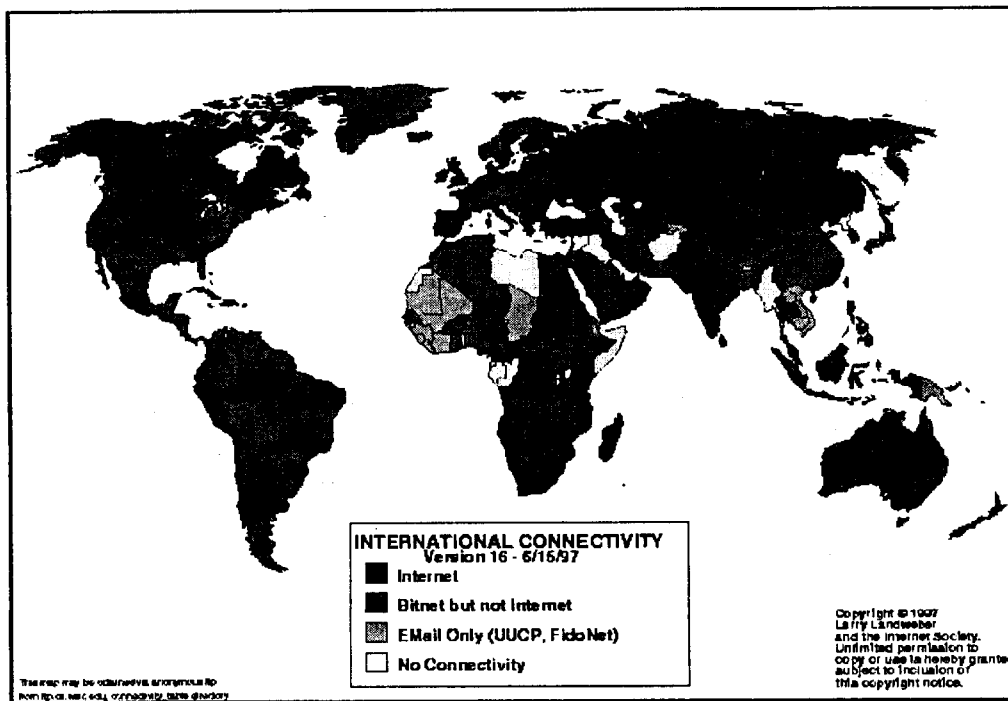
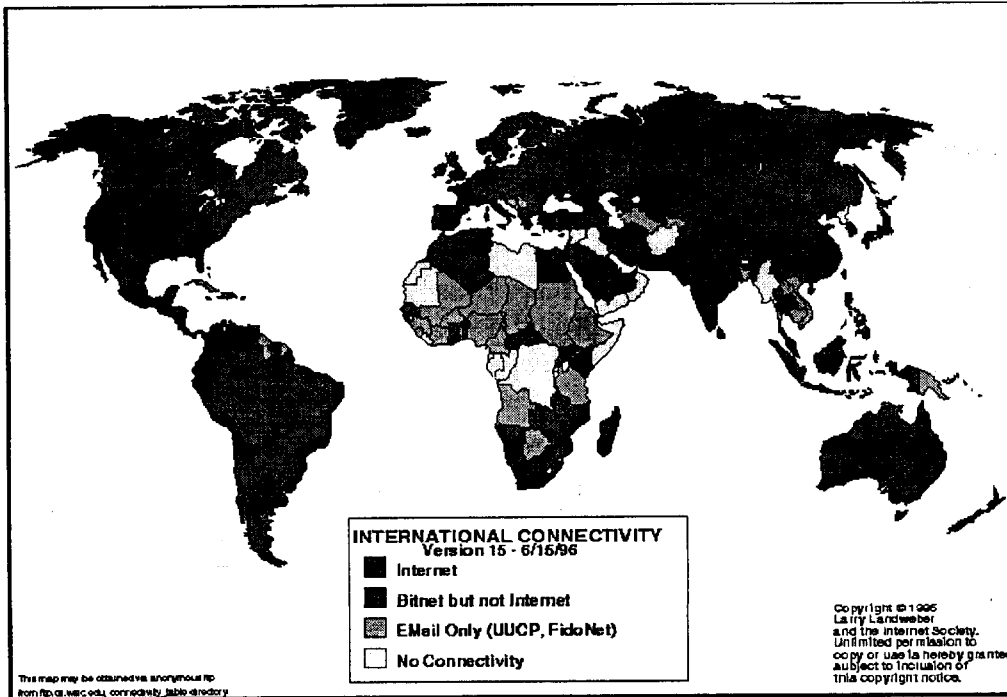


Fig. 1. The countries obtaining the Internet access in 1996 and 1997.
Source the Internet Society & Larry Landweber

not considered in this survey. Integrated Learning Packages (ILP) can be an example of such tools. They implement most of the existing Internet-technologies (WWW, e-mail, push- and pull-technologies, etc).

One may adopt **types of communication** classified in accordance with possible combinations of the participants in the communication process as a basis for sub-division of the Internet-technologies used in education. This approach based on the above mentioned typology, was proposed by L. Harasim (Harasim, 1989), M. Rapaport (Rapaport, 1991) and M. Paulsen (Paulsen, 1995, 1998):

1. "Single" communication type—implies the absence of bi-directional communication (person-to-person relations) and is characteristic of a situation involving an information inquiry (e.g. on-line resources software: browsers, FTP-clients, search systems, Telnet-terminals).
2. "One-to-one"—assumes the presence of bilateral communication (e.g. electronic mail).
3. "One-to-multitude"—this type of communication is performed when information is distributed from one source to many recipients (e.g. listservers, BBS and WWW, including tools for hypermedia publishing, streaming audio and video, pull- and push- technologies, authentication and encryption systems)
4. "Multitude-to-multitude"—accomplishes multilateral multi-directional communication, where all participants in the communication have the same status (e.g. WWW, USENET, BBS, synchronous and asynchronous teleconferencing, and virtual reality systems with embedded programming language (MUD, MOO)).

Since 1998 US university communities have joined together with government, industry partners and international participants to accelerate the next stage of Internet development in academia—Internet 2 (I2) (<http://www.ucaid.edu>). I2 is a collaborative effort to develop advanced Internet technology and vital to research and education missions of higher education. Internet 2 is working to enable applications, such as tele-medicine, digital libraries and virtual laboratories that are not possible with the technology underlying today's Internet. I2 is helping to develop and test new broadband technologies, such as IPv6, multicasting, and a quality of service (QoS) that will enable a new generation of Internet applications in education.

2.3. Usage of Internet technologies in teaching and learning

Successful activities: achievements

Information retrieval

As P. Merrill with co-authors notes (Merrill et al, 1996), A. Barron and G. Orwig (Barron & Orwig, 1995) and others, the Internet is a large source of reference materials and data, required for all types of educational activities—in studying/learning directly, in management of educational systems and in scientific and methodical work.

1. One of the most important advantages of the Internet in the area of information inquiry is the **increased accessibility** of reference materials and

data for all categories of users. As R. Owston (Owston, 1997) writes, Internet "is a truly open technology", allowing users with any hardware and software to derive the necessary information from the network, independently from the location of data and knowledge bases. Thus, within the framework of national educational systems, inequality in distribution of information bases, concentrated usually in big centres, is overcome.

2. From the international point of view, there is a **possibility to decrease the gap in the quality and quantity of information provided for education between developed and developing countries**. G. Sadowsky (Sadowsky, 1996) thereby notes that "Development experiences in one country can be useful in other countries; for recipient countries the trick is to discover similar projects and relevant information that could be useful to them". As an example, one can use the experience of MINISIS project (one of the versions of UNESCO ISIS system), where databases which are critically important for development and education information, accumulated in developed countries, were supplied to developing countries (in this case to the African region).

3. The third frequently mentioned advantage of the Internet in this sphere is the **quickness of information retrieval**, including online access mode. For example, S. Clemmit (Clemmit, 1996) refers to the server "Real-time TAO Buoy Data Display" (<http://www.pmel.noaa.gov/toga-tao/realtime.html>)¹ as a valuable real-time source of data for learning in the course of physical geography.

4. One more achievement of global network technologies in the considered field is the decrease in the **cost of information delivery** to users. Thus, most state run schools (not only in developing countries) are limited in the possibility to acquire the necessary quantity of printed copies of the most authoritative reference and informative publications. In this case, even taking into account the expense of hardware, software and communication channels, it is efficient enough to use online publications, such as the encyclopaedia "Britannica Online" (<http://www.eb.com>), the dictionary "Merriam-Webster Online" (<http://www.m-w.com/netdict.htm>) and the atlas "Altapedia Online" (<http://www.eb.com>).

5. We must underline that the integration of information resources from different countries and regions leads not only to increased accessibility, but also to the **quantitative growth and qualitative diversity** of the remotely delivered information, with no need for each educational institution and single user to acquire and maintain expensive and complicated equipment, required for placement of large quantities of information. G. Marchionini (Marchionini, 1988) notes that Internet-systems allow the storage of volumes of information of various types. Most of researchers thereby agree that they are not scattered and subject-area-specific data and knowledge bases, but complex virtual libraries, which can potentially become the most valuable source of information on the Internet. Virtual libraries particularly, become the source of information, which is most often addressed by students. Thus, UCLA Graduate School of Education & Information Studies (<http://www.gseis.ucla.edu/intro2.html>) conducted research among 400000 first year students of

¹ All Internet hyperlinks (URLs) in the survey were revised on March 23, 1999.

more than 700 universities of USA, and found that 82.9% of them actively use Internet library resources.

Among the functioning projects concerning virtual libraries, one can distinguish "The Internet Public Library" (<http://ipl.sils.umich.edu>), containing, apart from catalogues and reference information, more than 7700 texts, accessible online.

The digital form of representation of information on the Internet and the continual growth in the efficiency of equipment made it possible to process and distribute via the network not only texts, but also images, audio and video records. As it is mentioned in the UNESCO International Report on Education for 1998, "regarding the hardware, large growth of possibilities of data processing has occurred in recent years... As a result of converting data into digital form... the computer has the ability to work with multimedia (can supply user with text, image and sound)" (The UNESCO International Report on Education for 1998, Paris 1998). Thus, Internet virtual libraries gradually transform to multimedia, or digital, libraries. One of the most illustrious examples of such a database is the project "American Memory home page from the Library of Congress" (<http://lcweb2.loc.gov/ammem>), where more than 5000000 images, texts and video-records are offered. Widely used for educational purposes the specialised digital library of the Perseus project (<http://perseus.tufts.edu>) contains Ancient Greek texts—original and English translations, maps, photographs, images of antiques and architectural plans.

A resource of no less importance for all participants in the educational process is software. For example, the division "Education" of a large software library "Download.com" (<http://www.download.com/pc/cdoor/0.323.0-10.00.html?st.dl.fd.cats.cat10>) contains several large subdivisions (Kids, Language, Literature, Mathematics, Miscellaneous, Science, and Teaching Tools) with thousands of software products and with the possibility of choosing by criteria such as "only new" or "most popular".

Individualised learning and teaching

With the network-oriented character of the Internet, giving some researchers the reason to consider it as a mass-communication medium, we should not underestimate the prevalence and importance of the "person-to-person" type of communication on the net. For a long time electronic mail has remained the only Internet application in education. The data, submitted in the above-mentioned UNESCO survey, testify that electronic mail is still the most frequently used computer technology in open and distance education (see Table. 4).

As many researches point out (for example, Davies, 1998), the advantage and disadvantage of e-mail in education become clear, when it is compared with two other communication media, which for quite a long time have been applied in distance education (to be more exact, in "studying by correspondence")—with snail-mail and telephone.

1. The advantage of e-mail over snail-mail is the **quickness of delivery**, measured in a matter minutes. The quickness of interaction between participants in the educational process is not dependent on the distance.

2. Telephony also provides instant connection, but it is limited by the requirement for synchronous communication. **Asynchrony** of e-mail

makes it possible to receive and send messages at any convenient time, which is especially important in the situation when correspondent and respondent are located in different time zones. This characteristic of the communication of the "one-to-one" type, allows, according to G. Kearsley (Kearsley, 1997), an increase, compared to synchronous communication, in the quality of interaction between the learner and the teacher, owing to the time lag the learner has for processing the messages. According to M. Paulsen (Paulsen, 1995), the asynchronous mode contributes to involvement in discussion of teaching material by the learners, psychologically not inclined to that in the conditions of a real classroom environment.

3. Compared to telephone communication, the **e-mail communication** is characterised by low **consumption of resources**, including low costs of teaching the users, required equipment and data channel. Because of this, according to M. Van Gorp and P. Boysen, (Van Gorp & Boysen, 1997) and W. Johnson with co-authors (Johnson, Blake, Shaw 1996), e-mail is widely applied in the educational process (especially in case of the territorially distributed teaching staff).

4. Despite the extensive development of new Internet technologies (WWW, streaming video and audio, push- and pull-technologies), many researchers point to the **didactic effectiveness** of teaching via e-mail. Although the teaching materials, received by the learner, are very much similar to the traditional printed guidebooks, the simple and linear (unlike hypertext) structure of the course and of the control assignments is an advantage for many learners who cannot get their bearing in the over-structured teaching environment with an excessive number of informative links.

5. Many researchers point out that apart from the immediate teaching goals, the use of e-mail plays an important role as a medium which regenerates the epistolary culture, thus contributing to the **development of communication and writing skills** (Davies, 1997). J. Ellsworth (Ellsworth, 1994) thereby writes: "learners begin to work on their language and grammar, as never before. When children know they will receive a response from Stockholm, they begin to realize the difference between slang and literary language". As P. Groves with co-authors writes (Groves, Lee, Stephens, 1997), "e-mail makes it possible for students to stay in touch with their peers and with the teaching staff where a loaded schedule may make this otherwise difficult. The figure of the lonely scholar, who can become isolated through increasing specialization, or for more prosaic reasons of inadequate social or language skills, is one to whom e-mail presents some interesting possibilities"

6. A relatively new phenomenon in the practice of educational communications is the currently established tradition of the **learners speaking directly to experts** in one or another field (which can already be considered as the consequence of the increase in the level of communication skills among the learners, actively using the Internet). On the net, there are a number of centers of the type of Yahoo! Yahoo!igans!-School Bell: Homework Answers: Science: Ask a Scientist. Learners by addressing these centres can receive, via e-mail, answers to their questions on a particular theme.

Group learning and teaching via the Internet

An online lecture, or presentation of teaching material, published on the net fully or in part (as a summary), becomes accessible to many learners. At the first stage of the IAE implementation, the most common technology for this “communication paradigm” was the electronic bulletin board (BBS) and electronic mail discussion lists (listservs), where course notes were given with “read-only” access for students. After the beginning of the extensive implementation of originally interactive WWW-technologies in the distribution of educational information, various forms of courses on the WWW have become very common. Besides, the WWW technologies have made it possible for everyone to publish materials on the net. In the last case, the other learners can be the source (centre) of information for the learner.

Adopting the terminology proposed by B. Somekh (Somekh, 1996), one may say that the Internet allows the “maximisation” of learning, i.e., on one side to increase its “quantity” (as was shown by the example of increased accessibility of educational services), and on the other side—to improve its quality (if used in compliance with the teaching goals and objectives).

1. From the didactic point of view, it is, first of all, the **positive influence** of the applied Internet-applications **on the learner achievement**. As was mentioned in the “Report on the effectiveness of technology in schools, 95–96”, published IESD—independent consulting firm in the field of educational technologies “positive influence was found in all main spheres of education, from pre-school to high-school, as in the field of general education as well as professional education”. As a result of the meta-analysis conducted by C. Kulik and J. Kulik (Kulik & Kulik, 1991) carried out before the researches in the field of effectiveness of educational technologies of 1991, it became clear that the use of computer technologies gives better results of the learning (interpreted as the fastness of learning and the level of achievement) by an average of 20%.

2. In many respects, the researchers relate such effect to the fact that the Internet allows the process of teaching to be **more oriented towards a trainee**. This tendency implies a greater consideration of individual features of each student who now has an opportunity (provided by the AIE) to express all his/her ideas and ask all questions in the course of a lecture, which is a difficult task in conditions of a real classroom situation (Owen, 1993). As it is emphasised by D. Fetterman (cited by Owston, 1997), in this case each idea may be preserved for further consideration, selection and profound development.

3. **The opportunity of independent choice by a trainee of the speed of a teaching course** is also important. Moreover, the student can pass a certain level or stage of teaching as long as it is necessary for him (Pitt and Clark, 1998).

Web-applications make it possible for teachers to conduct teaching in such a manner and with application of such technologies, which for the modern generation of students present **an integral part of their life style** (Owston, 1997). In this connection the definition of the computer as “of a children’s machine”, given by S. Papert in 1993 (Papert, 1993), is frequently mentioned: according to him, children treat the computer in an absolutely different way as compared to today’s adults—they play with the computer,

have a good time with it, and learn with the help of it. Modern children learn more through visual images, than is the case with the older generation, as the modern world is rich in visual stimuli (to a considerable extent due to computers and telecommunications). Therefore, the method of application of Internet-applications in education (including all potentials of multimedia of WWW), and the application of the computer and telecommunication technologies in many respects depends upon the shift of the centre of attention of the process of education towards the student. As a result of the research on usage of computers at schools in 20 countries, conducted in 1989, it was revealed that in the majority of countries, covered by this survey, the computers in the families of school students are available to the same extent as the books (Beaton et al., 1996). As it is pointed out in the UNESCO World report on education, "as a result of all this, the school teacher who has taught more than ten years, and such teachers in the industrially developed countries present the majority, now deals with the type of a pupil which is different from what was known to him at the beginning of his teaching activities" (World report of UNESCO on education, 1998).

5. A direct consequence of this consists in **the change of the role of a teacher**, which is not eliminated in highly automated Internet-applications of the considered type, and is transformed from the role of a unique source of information and pedagogical effects into the role of a guide in the sea of information given by the Network, and of a creator (designer) of situations oriented toward the educational process.

6. **The change of the model of behaviour in the trainee** is also connected with the latter circumstance. The withdrawal from the reproductive model and the transition to creative pedagogy implies (in conditions of the above described changes of the role of a teacher) an emphasis on the development of independent activity of a student, development of critical thinking and skills in solution of real problems of science and business (Todd, 1996).

7. The development of such abilities and skills in the Web environment gives the researchers a reason to speak of WWW not just as of a method of delivery of information materials and methodical support, but also **as of a cognitive tool** intensifying the abilities of the human mind. The research literature has included a special term designating this aspect of application of AIE as "Mindtool". The usage of the Web in the capacity of Mindtool involves the student into learning not *through* computer-mediate communications, but *with the help* of the latter, which implies an intellectual partnership between the person and the computer to get an access to information and its interpretation, as well as organisation of the process of learning on one's own (Jonassen, 1996). In this context M. Connel (Connel, 1997) says that in the process of teaching/learning, preference should be given not to AI (Artificial Intellect—"artificial intelligence"), the attempts of which introduction into the sphere of AIE have not given, in his opinion, any significant result owing to technologically-oriented paradigm of its development, but to the IA (Intelligence Amplification—"development, expansion of mind")—just by virtue of the orientation of the application of technologies towards the problems and objectives of teaching. Such approaches can be based on a specific feature of the WWW technology,

namely hypertext (more precisely, its non-linear structure), which, according to G. Marchionini (Marchionini, 1998), presents basically homogeneous mechanisms of human associative memory.

8. The increase of the degree of the intellectual autonomy of learners has a direct effect on the **increase of motivation for learning and self-reliance**. As it is pointed out in the report, "The effectiveness of use of new technologies in schools": 1995-96 (Report on the effectiveness of technology in schools, 1995-96), students, effectively using AIE, are more successful in learning which results in higher level of their self-appraisal and self-reliance. Especially clear this tendency manifests itself in the situations where the Internet-application allows the students to measure his/her own progress.

Collaborative activities

The advantages provided by the Internet in organisation of co-operation are predestined by the very nature of the Network. As is known, World Wide Web (WWW) was formed as an environment specifically designed for collaborative work on the documents by collectives of researchers territorially remote from each other. The further development of technologies of the Internet has given an opportunity for joint use and the editing of both textual materials, but also of schedules, audio and video-sequences.

1. According to P. Groves, with the co-authors (Groves et al, 1996), the pedagogical significance of the given type of AIE consists in the fact that it allows the trainee not just to be involved in the single context of teaching, but it creates **opportunities for interaction** with each other and with the teacher. And in this respect it differs sharply from such types of educational activity, as, for example, obtaining data from the Web (Web-browsing).

T. Pitt and A. Clark (Pitt and Clark, 1997) single out some advantages of the group usage of the Internet by learners:

2. This type of AIE frees learners from the necessity to conduct sessions of teaching simultaneously with the teaching centre; that is, it provides **flexibility in teaching** for the students located in different time zones. The group of learners can interact irrespective of the mode of operation of an educational establishment. Thus the restriction imposed by synchronous types of AIE is removed.

3. WWW allows the provision of equal rights of the participants in a collective project regardless of their status. This circumstance, as many researchers emphasise, results in **growth of activity** of the learners.

4. WWW provides big **opportunities for rapid response** to the needs of learners (questions, consultations) from the side of the teacher directly during a teaching course, without interfering with other participants in the project.

5. The group projects on teaching allow **greater attention to individual features of the students** and their special spheres of interests to be paid.

6. Providing access to resources in the mode of real time, the WWW **contributes to the development of skills of collective work** (case studies, brainstorming, Delphi-groups and so on). P. Bell and E. Davies (Bell and Davies, 1996) especially emphasise that mutual assistance and effective exchange of ideas allows the members of a group to better present the whole possible set of research alternatives and after collective discussion to realise the best of them.

7. Due to the opportunity for asking questions and obtaining answers on the WWW in the mode of real time, that is the **high degree of interactivity**, that makes forums on the Internet especially effective.

One of the most vivid examples of organisation of joint teaching is the project KIDLINK (<http://www.kidlink.org>), within the framework of which more than 50000 students of schools from 77 countries in all continents participate in global projects and forums.

Main problems

Despite the existing achievements, evidences from the direct participants of the educational process, as well as researches shows that a process of information retrieval from the Internet is associated with the whole set of problems.

Information retrieval

1. The biggest barrier in obtaining data of any type for teachers, administrators, and, specifically, for learners is the **navigation problem**, residing in the lack of functionality (and, in some cases, even in total absence) of tools and systems for systematic description and cataloguing (Yang & Moore, 1996; McKenzie, 1996). Thus, according to S. Clemmit (Clemmit, 1996), she had had to spend almost a year (!) before she managed to find the sites with information, which could be used in the teaching of physical geography.

Here is what M. Gorman, the head of the library of Fresno University of California, writes on this matter: "The net is like a huge vandalised library. Someone has destroyed the catalogue and removed the front matter, indexes, etc. from hundreds of thousands of books and torn and scattered what remains... The net is even worse than a vandalised library because thousands of additional unorganised fragments are added daily by the myriad of cranks, sages, and persons with time on their hands who launch their unfiltered messages into cyberspace." (Library Journal, 15 September 1995).

2. Another problem, which can be observed as a derivative of the above mentioned, is the **problem of "cognitive overload"**—unreasonably large amounts of time, required for learning of system control function and for making the decision about future routes of net surfing (Yang & Moore, 1996; McKenzie, 1996)—which can be considered as a negative consequence of information redundancy of the Internet. A. King and A. Honeybone write on this matter: "by browsing through the multimedia, incidental learning is potentially greater than if the learner were just reading a text or listening to a tape. However, there is the danger that the very richness and variety of the choice may lead to cognitive overload" (King & Honeybone, "Needs Before Means: The Dialectics of Learning and Technology" 1996). The emergence of "cognitive overload" is also influenced by the lack of necessary navigation skills of most users, whereas the interface of many data and knowledge bases does not promote improvement of such skills, because it does not include a subsystem of self-teaching. Empirical research, conducted by D. Jones (Jones) showed, that the absence of navigation skills, while under cognitive overload conditions, is a primary, starting problem for most of the students. This problem, from the very

beginning, cuts them off from further, purposeful stages of the educational process on the Internet. Here is the estimation of the proposition “I need more help about the use of the Internet in the beginning of the learning course” by traditional learners, distance learners and total figure for all kinds of learning (indicators horizontally—SD—Strongly disagree, D—Disagree, NO—No opinion, A—Agree, SA—Strongly agree, indicators vertically—percentage of the total number of respondents):

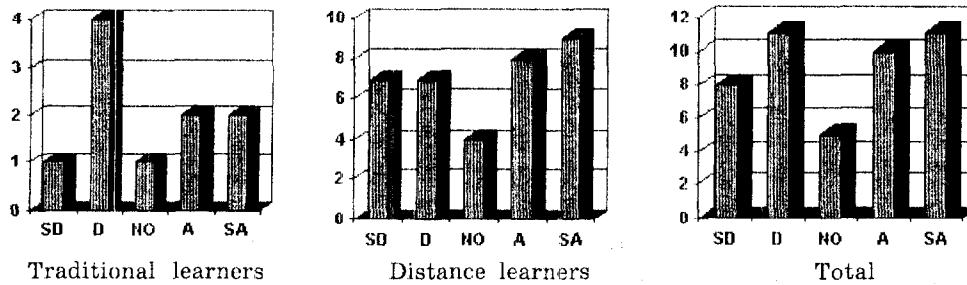


Fig. 2. The need for the teaching of methods of Internet usage. Results of learners' interviewing. Source—Jones, 1999

3. Information filling of the educational Internet is characterised by the **irregularity of distribution of represented information sources in accordance with their types**. Thus, if the quantity of educational journals on the net (pure electronic, as well as online versions of traditional publications) is considerable enough, then the number of possible examples of fully functional encyclopaedias and dictionaries with free and unlimited access is not large. Valuable statistical data in the field of education, especially in the field of utilising new information technologies, is found on the net much more rarely than, for example, legislative acts, regulating the educational process. This irregularity reaches such a large scale, that, in some sense, one may say only about the potentially high accessibility level of educational information on the Internet, despite numerous declarative statements of the opposite character. This conclusion is also confirmed by the data submitted in the UNESCO analytical survey “The usage of Electronic Media in open learning and distance education.” (M.V. Euler, D. Berg, 1998). In accordance with this research, access to databases, as a kind of educational activity on the Internet, is used only in 14% of all distance education and open learning programs.

Table 4

The kinds of communication media used in open learning and distance education. Source—UNESCO analytical survey “The use of Electronic Media in open learning and distance education.” (Euler, Berg, 1998)

Communication media	Usage in educational programs (percentage)
Telephone	84
Fax	64
Electronic mail	54
Audio-conferences	32
Video-conferences	22
Computer-conferences	22
Database access	14

4. The problems of legislative and public control over the Internet contents are a part of the general problem, which can be denoted as the trans-cultural nature of the net. It can become a difficult **trial of cultural identity** of the nations of the world. As was mentioned on the Second UNESCO-ACEID Conference, organised by UNESCO-ACEID in co-operation with the Ministry of Education of Thailand in Bangkok, 1996, new technologies pose, in particular, questions of their influence on the culture. In some countries, governments negatively consider accessing the Internet, since "it can break the culture" (Re-engineering Education for Change: Educational Innovation for Development, 1996).

As G. Sadowsky writes (Sadowsky, 1996), "The culture of the Internet reflects its roots in the North American research community. Important elements of that culture include broad freedom of expression and sharing of information. The element of freedom of expression has come in for criticism from a variety of sources as material-offensive to some-has been created and has become available on the Net". The simplest and the most obvious consequence of the described nature of the net is the demand for a language-mediator. "Concerns have been raised in some non-Anglophone countries that the Internet is either implicitly or explicitly a tool to promote the linguistic dominance of English" (ibid). As a result, even the materials, published on the net by non-Anglophone authors are often presented in English. Of course, this fact also does not encourage the increase in accessibility of educational information on the Internet for non-Anglophone users.

6. As the Internet is filled with multimedia information, inquirers for information from data and knowledge bases encounter **technical restrictions**, universal for the net, in this case—the limited throughput of data delivery channels.

Individualised learning and teaching

Among the problems, revealed by the experience of individual communications in teaching and learning via the Internet (basically using e-mail), one can distinguish the following:

1. First of all, there is the **problem of searching for a required address**. Although most existing e-mail software contains mechanisms for managing the lists of e-mail addresses, only several universal search engines can perform searches for required addresses by various criteria. While on-line address-bases for educational institutions yet present on the net (although, in a limited quantity), the search for an e-mail address of a particular teacher or specialist can be unrewarding.
2. Apparently, the absence of such technology can be attributed to the **unsettled questions of information security**. The struggle against unwanted advertising mail ("spamming"), the efforts to provide confidentiality of messages by using various encryption systems (which is especially important in distant making contracts at a distance—as with a learner ("learning contracts")), together with the teaching staff, has not lead to complete success.
3. The important problem, which directly influences the didactics of teaching on the net, is the **low degree of interactivity**. This quality of electronic mail, as D. Jones (Jones, 1996) points out, makes it difficult

to react timely to individual needs of learners, which finally leads to a feeling of isolation by teachers and other students. In the literature, devoted to the problems of distance education, a special term is introduced—"distance of interaction", which means the psychological space between learner and teacher, and is a function of the degree of "dialog" of their communication and of the timeliness of a teacher's answers.

Group learning and teaching via Internet

The majority of problems singled out by the researchers on the basis of the analysis of the experience of AIE application are connected with the fact that **the Internet-technologies originally are not specifically oriented towards their use in the field of education.** As it is pointed out in the World report of UNESCO on education, 1998, "the fact that large technological developments were motivated by the needs of education as such used to be a rare case. Most probably, on the contrary the education showed the tendency to the attempts of use for its own purposes of the technologies which were introduced in other fields" (World report of UNESCO on education for a 1998).

1. The problem of pedagogical efficiency in the use of new information technologies (including the Internet) in education is widely discussed in the research literature. Unlike the obvious and quantitatively valuable achievements in enhancing of the availability of education, the specific positive effect of the environment-intermediary on the quality of teaching is not obvious. Moreover, according to some researchers, for example R. Kozma (Kozma, 1994), for the last 50 years of the research of use of unconventional media in education (ranging from radio and TV broadcasting to WWW) have not revealed, however, any considerable specific effect on the process of teaching for the given specific type of environment. This idea is shared by R. Clark (Clark, 1994) considering that the new methods of designing for teaching by means of new information technologies may favourably influence the improvement of the quality of education, but not just their use as the means of delivery of teaching material.

Generalising this discussion, R. Owston (Owston, 1997) writes that the Internet, as any other environment-intermediary, cannot improve the quality of teaching. Strengthening this position, this researcher following G. Solomon with the co-authors (Solomon et al, 1991), considers that the use of the world telecommunication network as a means or tool of education does not contribute to shaping learners' specific cognitive skills and other skills, which would communicate only with the given technology. The key moment in promotion of WWW-technologies in education, in his opinion, is their effective utilisation in certain situations of teaching/learning.

2. Didactic difficulties of hypermedia usage (i.e. a complex of multimedia and hypertext) are classified by C. Yang and D. Moore (Yang & Moore, 1996) and J. McKenzie (McKenzie, 1996) in the following way (some of the problems are common for the first and the third of selected IAE types):

- more control over the learners (compared to the traditional educational type) is required, since many of the students either do not possess the methods of independent study in the WWW environment, or are not disciplined enough;
- difficulties with hypermedia navigation constantly emerge;

- many learners on the net suffer from cognitive overload;
- excess of information on the WWW generates a lack of self-confidence in the learners.

G. Marchionini (Marchionini, 1988) defines the following kinds of didactic problems:

- existing computer skills are not sufficient for teachers and learners to operate freely (read and write) information in electronic format;
- learners are often disoriented in WWW space;
- attention of Web-learner distracted by side flows of information;
- ergonomic problems, created by IAE, often do not allow learners to pay desired attention to the contents of the learning process;
- permanent and rapid changes on the net cause a series of psychological and sociological problems for the teachers as for the learners;
- specific problems for teachers emerge: the small experience of most teachers in hypermedia publishing and in management of teaching process in the WWW environment does not allow them to concentrate on stating educational tasks of projective pedagogy. The lack of methodically elaborated ways of control and evaluation of the learning process on the WWW is also felt.

Some other approach is demonstrated by D. Benyon with the co-authors (Benyon et al., 1997). He considers that hypertext in comparison with the traditional paper forms of presentation of educational material has not only an advantage, but also disadvantages: “the printed text is a very flexible means of teaching. The students can review the material wholly, and the authors of the book almost always use an opportunity to inform them of the book structure through dividing it into chapters, lessons and so on”. The author calls the teachers to seek not just to transfer existing materials to hypertext, but also to use potentials of its structuring and organisation specially to satisfy the needs of learners.

3. Another difficulty, important both for learners, and for teachers, is the **extreme time commitment required for teaching/learning** on the Internet. So, T. Montgomery and D. Harapunuik (Montgomery and Harapunuik, 1997) point out that it is necessary for the managers to be ready to face the fact that the temporary loading of teachers and learners will be much higher in comparison with the similar course taught “face to face”. According to J. Davies (Davies, 1997), the delays caused by delayed answers to the questions of a student in distance teaching and owing to problems with the computer equipment, increase the time spent by the student.

Much time is required for development and support of Web sites for educational purpose. G. Bothun (Bothun, 1996) in this connection points out that the long time of training of teachers to support a Web site is a serious disadvantage of Internet courses.

4. Finally, one can distinguish a specific circle of problems, connected with the changes of the teacher’s role mentioned above. Some authors say about a potential **danger of dehumanisation of education**, elimination of “the linchpin of the process—a personal contact between the teacher and the learner in the classroom” (The UNESCO International Report on Education for 1998). A. Barron and G. Orwig (Barron and Orwig, 1995). A. Barron and G. Orwig (Barron and Orwig, 1995) call on the educational community to remember the balance between the high tech (“high tech”)

education and the education “of a high level of contact” (“high touch”): the “live” teachers are essentially required to provide “the factors of contact” in our high tech society. The human sympathy and ability to analyse individual needs of the pupils remains in the field of activity of the teacher. J. Brunt (Brunt, 1996) asks himself a rhetorical question—“whether you can put a hand on the shoulder to the student in the Internet?”—and defends the humanist approach to the usage of Internet-technologies in education.

5. **Technological difficulties** of the development of IAE of the considered type most completely represented in the classification of C. Bouras with co-authors (Bouras, 1997):

- low throughput of the existing Internet channels;
- incompatibility of protocols and programming languages;
- poor support of audio- and video-flows in a real time mode;
- low interactivity level compared to teaching multimedia on CD-ROM;
- difficulties in conducting WWW seance of “one-to-multitude” communicative type;
- poor control over information representation formats on client computers and insufficient ability to manage these processes in time.

According to D. Snyder (Snyder, 1997), the technological difficulties of Web-applications in the field of education frequently present an obstacle for teaching. So, in the sphere of distance education the students and teachers frequently face the problem of adjustment of specialised software for access to the Internet. The disadvantages of a network infrastructure of educational institutions strongly influence the learning efficiency. Mistakes in selecting of equipment and types of communications made by the administration and technical experts result in the fact that the students experience difficulties in connecting with the server (Owston, 1997).

Collaborative activities

The basic difficulties in the usage of IAE for organising collaborative activity in teaching/learning are:

- **administrative-economical** problems—the obligation for educational institutions to allocate hardware and communication resources (sometimes fairly expensive, considering the requirements for the number of simultaneous users, etc.), originally designed for the group of organisations, administratively independent from each other;
- **personnel** problems—the obligation for an educational institution to select from the teaching staff a special group of teachers for supporting a network of collective projects;
- **methodical** problems—most of the teachers currently do not have the skills, required for managing collaborative educational projects on the net;
- **technological** problems—the Internet-technologies and particular software applications (e.g. teleconferencing systems), supporting this type, according to D. Jones’ conclusions (Jones, 1999) are not of an affordable price for educational organisations, since these products were originally developed for business. They are also relatively complex for non-specialists and, finally, are platform-dependent (this limits the sphere of their application).

2.4. Internet and the organisational aspects of education

Successful activities: advantages

Management of educational organisations using Internet technologies

1. The Internet-technologies in recent years have been widely applied in the practice of management of educational institutions. The first step which is usually made in this direction is the creation of a Web-page, and then a WWW-site as well, performing representation, advertising-information functions—informing on specialities on which the teaching is given, on conditions of learners' entry and residing, contact information etc. Many researchers (DeLoughry, 1995a; DeLoughry, 1995b; Glazer, 1996) point out that the Web-presentations are today **the most effective means of advertising-information support** of activities of educational institutions at different levels. The low cost of publication provides high efficiency of presentation of educational systems and courses, management of the distributed teaching staff and attraction of new entrants to educational institutions. So, in the Russian Federation about 300 higher educational institutions have such sites.

2. With the development of the university WWW-sites, the set of their functions expands at the expense of not only directory service, **but also organisation of academic, scientific and administrative activity** of educational institutions.

For example, the WWW-site of Moscow State University (<http://www.msu.ru/russian/index.html>) has the following sections: General Information (including the history of the University; the charter of the University; Academic Council of MSU; structure of MSU; public organisations; dormitories of MSU; statistical data on the contingent and graduates; essential elements); Information for entrants (including rules of entry, conditions of entry and teaching for foreign students; pre-university teaching in MSU; information on the latest entrance in MSU; addresses and telephones of entrance boards etc.); Research Work; Editions of MSU; Student's life; Employment offer; International ties.

Delaver state university WWW-site (<http://www.mis.udel.edu/main/webinits>) exists since August 1993 and responds to the needs of students, faculty and staff, visitors, and alumni, whose daily tasks could be made easier through new and creative usage of the power of the Internet. It helps the University community find information or get things done with more efficiency and less difficulty.

Intranets

Internet technologies have begun to be widely used in the management of education due to the reorganisation of local computer networks with the use of the TCP/IP and WWW-server protocols. Such networks have been named Intranet—a private computer network based on the communication standards of the Internet. Intranet is a smaller version of the Internet that only the members of an organisation can see. Educational organisation can create, within their walls, a manageable, secure version of the World Wide Web. These internal Webs are growing from an explosion in the use and

understanding of Internet technology. Due to the complete compatibility with any hardware-network, complete scalability, independence from physical realisation of channels, orientation towards the architecture "customer-server", economical use of the passband of the network connections, integration of the existing networks into a single system, economic efficiency and ease of use, and, especially, high security (protection from Internet users by firewall), in the networks of Intranet the realisation of diversified administrative functions has become possible (Downing, Charles, Rath, 1997).

D. Murphy и D. Andrews (Murphy & Andrews 1996) remarks, that an intranet can facilitate use of more complex data structures, protect data security, allow tracking of information and forms, eliminate hard-copy manuals, maintain up-to-date schedules, and reduce paper waste and other costs.

D. Holland (Holland, ERIC_NO: ED425717), describing the phases of Community College MI Mott Intranet development, specifies the following: The first goal was communication, which included using the following technology to allow people to communicate and to make information available by e-mail, calendaring, Intranet/Internet, campus directory, open positions database, human resources information system, World Wide Web-based course schedule, purchasing procedures online documentation, press release database and reports system. The second major task was to build systems of co-operation; the goal was to develop automation systems that would allow work to flow more efficiently between people. Included were the current events system, help desk service request database, facilities service request system, book request database, and room scheduling system. The third step was to build collaborative systems, which would allow teams of people to work together to accomplish common goals. These systems included online purchase requisition and approval, grievance tracking/solution system, and faculty information management system.

In Assumption University of Thailand (<http://www.intranet.au.edu>) the Intranet-centre unites around the main WWW-server, the document procession process of the departments of the staff management, finance administration, administrative managerial control, department of international relations, office of the head of studies, information and audio-visual centres and other sub-structures of the university.

The Intranet for University College London (<http://www.intranet.ucl.ac.uk>) has been developed exclusively for the Staff's administrative requirements and provides information specifically tailored to personal and working needs of the college staff while the UCL website is re-developed to focus more strongly on its external audience.

The UCL Intranet provides access to information, which may otherwise be difficult to locate. For example, the How to Guide aims to answer such questions as "How do I organise audio-visual equipment for a meeting?" This section is organised under key words and sample question headings. The sample questions are not an exhaustive list of the areas covered. They are intended to help define and indicate the breadth of the subjects covered under each of the key words.

Key Documents links to internal College documents such as the Academic Manual, The Gold Book and further documents as they become available in web format.

Members of UCL can find the email addresses of registered Web Coordinators for every department and division under Master Index, while the Mailing List is a role based mailing list from which you can generate address labels. Finally, quick links to administrative divisions and departments including contact lists, organisational charts and roles and responsibilities (where available in web format) are accessible include Teaching, Research, Finance and Personnel pages for Staff. Continued development will see other parts of the UCL community benefit from this internal communication resource. In time, Students will have live access to their own records and exam results, Alumni will have the opportunity to network online and Departments will benefit from the secure environment an Intranet allows.

The UCL Intranet is available to all UCL Staff who have valid Information Systems (IS) Accounts and are registered on the UCL Personnel Database.

Cost and effectiveness

According to P. Groves with the co-authors (Groves et al, 1996), it is first of all necessary to draw a distinction line between the external reasons (motivations) for which the AIE are introduced into the practice of educational institutions, and the immanent, resulting from the internal logic of the development of educational systems. These authors with the co-authors (there) give the following reasons of the 1st group:

- pressure of public opinion which frequently equates the concepts “the latest methods of teaching” and “the most progressive methods of teaching”;
- expectations of the entrants preferring to obtain only the “latest” kinds of educational service for payment;
- requirements of higher administrative bodies pursuing the policy worked out in a certain political context, in the field of education.

1. The reasons of the second group (immanent) first of all include the **increase of availability of teaching**. According to R. Owston (Owston, 1997), despite disagreements in the definition of this criterion, the majority of researchers agree that the introduction of Internet-technologies makes education more accessible for many people. Offering opportunities for training right at work, in remote areas and at home; this type of AIE overcomes geographical and time barriers and plays more and more important role in distance education. Web-based teaching, according to J. Davies (Davies, 1998) can complement or replace traditional educational opportunities offered earlier by means of mail correspondence, distribution of printed educational materials, audio- and video-tapes, or through TV-broadcasting.

According to W. Bates (Bates, 1995), availability is the most important criterion for making decision on the suitability of a certain technology for open or distance education.

2. The second, most frequently mentioned advantage of AIE, mentioned in the literature, is the **increase of economic efficiency of activity in educational institutions**. M. Moore and Kearsley (Moore and Kearsley, 1997) point out that, since DE is a part of the system of education, the introduction of distance education renders a complex influence on the economy of education: if the programmes, earlier offered to audiences, are transferred to DE, then the need for premises, car parking space is reduced,

the transport traffic becomes less intensive, costs of municipal services, security, land lease, and so on, are reduced.

A. Romiszovski (Romiszovski, 1993) emphasises that “while the cost of telecommunications regularly goes down, the cost of the real estate and land, the costs of labour and transport regularly grow”. H. Perraton (Perraton, 1994) conducted research of 16 educational institutions in various parts of the world, as a result of which he revealed that the costs of one trainee under the distance education programme on the average are lower as compared to the similar programme of a traditional type.

According to H. Freeman and S. Ryan (Freeman and Ryan, 1997), the non-profit programme organised for a limited quantity of learners at the territory located next to the educational establishment, can with the minimum costs be offered to entrants world-wide. This opinion is shared by C. Faulhaber (Faulhaber, 1996) who considers that realisation on the Internet of specialised educational programmes can be most economically effective, in conditions of universities usually attracting a very limited number of learners. According to G. Rumble (Rumble, 1992), “distance education allows for a limited quantity of teachers to train a very large number of students”. Thus, the factor of the ratio between the teaching staff and learners becomes smaller.

3. According to P. Groves (Groves, Lee, Stephens, 1997), an economic circumstance specific to the WWW is the **low cost** (and sometimes free forms of provision) of **necessary software**—Web-browsers and Web-servers. The same authors draw attention to the extremely low cost of distribution of publications of educational materials on the Network.

4. According to the report of J. Walsh and B. Reese (Walsh and Reese, 1995), it is pointed out that distance education allows educational institutes to develop **new markets of educational services**—such as corporate training, training of adults and professional instructing.

5. In the end, in the sphere of administrative activity **the opportunity of exchange of educational resources between educational establishments** is important—ranging from the joint development of most resource-intensive courses of distance education to the creation of the distributed educational institutions. This kind of joint activity allows schools and universities to greatly reduce the cost of introduction of new information and telecommunication means into the teaching, and also to reduce the costs of construction of the distributed systems DE.

Staffing

1. M. Van Gorp и P. Boysen, (Van Gorp & Boysen, 1997) и W. Johnson with co-authors (Johnson, Blake, Shaw 1996) point out that electronic mail due to its low resource-intensiveness is widely applied in the **management of territorially distributed collectives of educational institutions**.

2. The most important advantage provided by AIE for teachers, methodologists and developers of courses is **the opportunity to exchange experience and continuous improvement of professional skills** through participation in various teleconferences. (Mumford, 1995: Thomas et al., 1996) write that the teachers using constantly changing telecommunication means and computer equipment are critically in need of this type of AIE.

Distance education: an institutional impact of Internet-technologies

The important consequence of the application of Internet-technologies for the development of educational systems at different levels is the development of distance forms of teaching. The traditional methods of delivery of educational materials and organisation of feedback with the learners—such as mail and telephone—are replaced by the electronic mail and the WWW.

The educational institutions of different types and educational levels provide opportunities for teaching through the WWW. An example of the use of Internet-technologies in higher education shall be the specialised distance educational institutions delivering a considerable part of educational materials through the WWW: British Open University (more than 120000 students) <http://www.open.ac.uk>, the Open university of Hagen (Germany) (more than 50000 students) <http://www.fernuni-hagen.de>, INTEC college in Cape Town (RSA) <http://www.intec.edu.za/> (more than 68000 learners), Modern humanitarian university in Moscow <http://www.muh.ru> (more than 60000 students).

Many traditional higher educational establishments introduce separate distance courses (for example, the course on fundamentals of protein structures in the Birkbeck College of the University of London <http://www.cryst.bbk.ac.uk/PPS>) or single out in the structure separate divisions (UCLA Extension <http://www.unex.ucla.edu>).

It is important to note that the majority of educational institutions are provided with opportunities for obtaining through the Web a bachelor degree, and some—the degree of PhD. (School for Transformative learning of the California Institute for Integral Studies <http://caso.com>).

The degree of development of distance education in higher educational institutions of advanced countries may be evaluated on the basis of the example of USA, where still in 1995 more than 58 % of high schools or practised distance courses were planning to introduce the distance teaching during the next three years (see Table 5).

Table 5

Percent of USA higher education institutions currently offering DE courses, planning to offer DE courses in the next 3 years, not currently offering or planning to offer DL courses: 1995. Source—U.S. Department of Education, National Centre for Education Statistics. Statistical Analysis Report: Distance Education in Higher Education Institutions. October 1997 (NCES 98-062)

Institutional characteristics	Currently offering distance education courses	Planning to offer DE courses in the next 3 years	Not currently offering or planning to offer DL courses
<i>All institutions</i>	33	25	42
<i>Institutional type</i>			
Public 2-year	58	28	14
Private 2-year	2	14	84
Public 4-year	62	23	14
Private 4-year	12	27	61
<i>Size of institution</i>			
Less than 3000	16	27	56
3000 to 9900	61	24	15
10000 or more	76	14	10

Though the prevailing sphere of distance education is presented by higher and post-graduate teaching, DE gradually begins to be used in high schools as well. R. Owston (Owston, 1997) singles out three areas of secondary education, where the AIE are obtained. First, this includes home education: due to the Web, children to a smaller extent suffer from the shortage of educational materials and the lack of dialogue with classmates—two main disadvantages of home education. Secondly, this alternative education presuming the freedom of choice of a school is sometimes territorially remote from the place of residence of a pupil. For the third, AIE of this type begins to be applied for giving extra courses to the pupils, in particular in preparation for entry to higher educational institutions.

On the whole, as it is pointed out in the analytical research conducted by M. Brennan (Brennan, 1992), the distance education more obviously becomes real at all educational levels and in all sectors of education.

With the absence of statistical data, a certain idea about the dynamics of the growth of distance education courses can be given by the quantity of courses registered on the server of Global Network Academy—a non-commercial consortium in the sphere of DE: if in 1998 15000 courses were registered, for comparison in March, 1999—more than 17000.

Main problems

Management of educational organisations

1. New technology, in the form of electronic connectivity, has opened up vast new arenas of educational development. Many administrators, however, have not been prepared for the sudden change brought about by such technology. **The problem for educational administrators** is how to lead effectively without being overcome by the new information technologies. Some papers (e.g. Ross, 1996) provide guidelines for administrators and administrator educators in organising activities that will allow the effective integration of digital communication technology into school settings. Ross discusses the five important program elements of hardware, software, curriculum, staff development, and control over access.

2. The experts of the National Center for Higher Education Management Systems (NCHEMS) (<http://www.nchems.com/>) states, that “in this time of rapid technological change, many **colleges and universities have not been able to keep pace with the growing information needs of the institution**. Computing hardware becomes obsolete before it is paid for, software barely meets the transaction processing needs of operational units, and management information needs are unrealised. Usually an over-worked computing centre staff is hard pressed to satisfy the day-to-day information processing needs while maintaining out-of-date systems, and the backlog of new requests grows exponentially. Some frustrated users design sub-optimal and uncoordinated microcomputer systems, while others simply limp along. Top administrators are reluctant to add resources without a clear plan, and the information technology staff is unable to articulate a plan without additional resources. Even in institutions that are well served by information technology, top administrators may wish to have an external assessment of their technological environment. This is particularly true if any major changes in computing hardware or software are anticipated”.

3. Ernst et al. points out five key areas of change impacting on higher education administration: funding sources, public expectations and state mandates, consumer expectations, evolving organisation structures, and increasingly sophisticated workers. He describes **outdated organisational and technological strategies** for dealing with these trends and summarises new ones (Ernst et al., 1994).

Cost and effectiveness

The most frequently mentioned problem of IAE usage is the **optimisation of the cost of educational service provision** via the Internet. Thus, G. Rumble (Rumble, 1992) believes, that until the problem of optimal balance of the initially required investments, the number of learners and the type of the used technological environment-media is not solved, one cannot hope for economical effectiveness in conducting distance education courses.

R. Owston (Owston, 1997) considers three components, composing the cost of educational services provision via the Internet. First, it is software and hardware. As was mentioned above, the basic types of software for the WWW in education—namely Web-browsers and servers—are supplied either free of charge, or for minimal payment (Internet Explorer browser is distributed free of charge, Netscape Communicator is free for private use and academic institutions, the most prevalent Web-server Apache is also free). The main part of the expenses falls on hardware and on data channel lease. So, if teaching is conducted for a small number of students, then payback period extends over a long term. In case of an increase in the number of learners, the demand for acquiring more powerful (and more expensive) equipment and for the use of more broad data channel occurs.

The second component of the expenses for teaching via the Internet is the expenses for development of the courses specially designed for the net, since plain delivery of the existing teaching materials, designed for teaching in a classroom, does not achieves the declared pedagogical objectives. R. Owston emphasises, that the expenses for the development of DE courses must include not only payments to teachers and methodologists directly, but also to a whole brigade of technical specialists. The last aspect is not always taken into account when making the decision on whether to start teaching via the net.

The third component of the expenses for providing DE is just the need to pay for the work of the collective of specialists, conducting permanent (sometimes around the clock) technical and methodical support of the distance education software, including publishing the new and removing obsolete materials, control for hyperlinks relevancy and improvement of the design and implementation of the new permanently emerging software technologies like Java-script (Mike, 1996).

2. An important global problem of IAE application is the **socio-economic inequity in possibilities of accessing the Internet** (Wampler, 1996). Apart from the necessity for each learner to have a personal computer, distance learning, unlike most educational institutions, forces students to use the services of local commercial Internet-providers. Despite the fact, that, as shown before, getting on the Internet on a global scale sharply activated last years, the degree of having access to the net among educational institutions (unlike business sphere), and,

especially among individuals considerably varies from country to country. While the percent of USA public schools having Internet access for the period from 1994 to 1998 had grown from 35% to 98% of the overall quantity (i.e. by 2,8 times), the Chad National Report on 45-the International Conference on Education in Geneva in 1996 indicated that only 9 obsolete personal computers with no Internet access were used in the Chad educational system.

Table 6

Percent of USA public schools with Internet access: by 1994, 1997 and 1998 data.
 Source—U.S. Department of Education, National Center for Education Statistics.
 Internet Access in Public Schools and Classrooms: 1994–98.
 February 1999 (NCES 99-017)

School characteristic	1994	1997	1998
<i>All public schools</i>	35	78	89
<i>Instructional level</i>			
Elementary	30	75	88
Secondary	49	89	94
<i>Size of enrolment</i>			
Less than 300	30	75	87
300 to 999	35	78	89
1000 or more	58	89	95

As was mentioned at the Second UNESCO-ACEID Conference, organised by UNESCO-ACEID in co-operation with the Ministry of Education of Thailand in Bangkok, 1996, “the access to computer technologies for developing countries varies according to their wealth” (Re-engineering Education for Change: Educational Innovation for Development Re-engineering Education for Change: Educational Innovation for Development, Report of the Second UNESCO-ACEID (Asia-Pacific Centre of Educational Innovation for Development) International Conference organised by UNESCO-ACEID in co-operation with the Ministry of Education, Thailand, Bangkok, 9–12 December 1996).

Staffing

Research indicates that to accomplish the profound changes associated with the integration of technology in the overall learning environment, there is a real need for **teacher training and support** at all levels (e.g. Means, 1993, Aust and Padmanabhan, 1994, etc.). In Means (1995) observation is reflected that “sites most successful in infusing technology throughout their entire programmes were schools and projects that also devoted a good deal of effort to creating a school-wide instructional vision—a consensus around instructional goals and a shared philosophy concerning the kinds of activities that would support those goals. What appears to be important is not the point at which technology becomes part of the vision but the coherence of the vision and the extent to which it is a unifying force among teachers”.

The evidence in the SPA report (Report on the effectiveness of technology in schools, 95–96) suggested that teachers who use technology in their classrooms are more effective if they have received training, if they

have district-level support and if they have a network of other computer-using teachers to share experiences with.

It has “become clear over the past decade that simple motivational and short-workshop schemes are vastly insufficient to enable veteran (and even new, computer-generation) teachers to teach differently, and to teach well with technologies” (Hawkins and Honey, 1993).

Legal and ethical issues

One of the most painful problems in this sphere is the legal regulation and the whole set of juridical and ethical questions associated with that.

1. Credentialing and certification problem. Jones, D. (Jones, 1995) states, that “the “virtual university” created by the technological delivery of instruction, while providing access, lacks formal recognition by employers and institutions of higher education provided by credentialing and certification systems. Certification and quality assurance should focus on the assessment of learning and learners, based on specific, standardised, and widely accepted competencies rather than on courses or other instruction units delivered by providers. Assessments must be acceptable to employers and other institutions and be conducted with integrity. Credentialing and certification may be implemented incrementally and regionally and through a variety of types of organisations”.

2. Ergonomics standards in some countries regulate only the professional-purpose usage of information technology tools. Thus, the learners are out of governmental control in these aspects.

3. As Loundy (Loundy, 1996) notes, it is not always effective to protect copyright on materials, represented in digital form. V. Veselago writes: “unfortunately, most editorial departments avoid publishing full-text electronic versions of their journals, being afraid of decrease in the size of the paper version circulation” (Thesis to conference “The Internet and the modern society”, 1998).

4. Researchers inform about problems, associated with difficulty of functioning on the Internet of the well-established in the sphere of traditional information circulation by social and legal institutions as censorship (Young, 1997; Censorship and the Internet in Schools: Problems and Solutions, 1996) and prevention of minors accessing inappropriate information (Wagner & Wagner, 1997).

5. Questions of providing security of information on the Internet are broadly discussed in the literature. The most important problem is the problem of misinformation prevention—as the misinformation of potential entrants by educational institutions, as well as the misinformation of faculty and staff of educational institutions by unscrupulous students (Fitzgerald, 1997; Floridi, 1996; Safford, 1996). Further development of integral components of IAE of this type—systems for testing and control of knowledge—is in many ways dependent on the solution of this problem. As the researchers believe, free distribution of cryptographic tools of high reliability can partially solve this problem.

The concept of “open educational communities” (Open Learning Communities, OLC), offered by UNESCO within the framework of the project jointly with UNICEF “Education without frontiers” (Learning Without Frontiers, LWF)

A special, integral type of AIE shall be recognised to be the “open educational communities” (Open Learning Communities, OLC). As it is pointed out in “Technology and Learning Portfolio” of LWF program, OLC development is based on such contemporary global processes as globalisation/localisation, appearance of technological and information companies, growth of the number of informal institutes, democratisation, cultural homogenisation and growth of attention to the problems of preservation of the biosphere.

According to the head of the LWF program J. Visser (Visser, 1998), typologically OLC differs from the systems of distance education by the fact that “OLC, in terms of its nature, cannot be created by an external agent. They are designed directly by the participants of a community”.

So, in the field of administration of educational systems within the framework of the LWF programme the regional, national and institutional educational policies are developed. In 1996, the project “Training of teachers of elementary schools on the basis of distance education achievements” for nine countries of Asia was realised.

In the field of development of the network co-operation it is possible to single out the project “Creating Learning Networks for African Teachers” whose objective is to provide new opportunities for the teachers of Africa and their institutes in their activities on technological innovations in training.

In the field of research work, a typical example of OLC activity is “Junior Summit” conducted with mediation from UNESCO in 1998 in Boston (USA) within the framework of which more than 1000 children from the entire world took part in the on-line forum, discussing problems and exchanging experience.

**3. INFORMATION SYSTEMS ON EDUCATION VIA THE INTERNET:
FUNCTIONAL FEATURES, OFFERED INFORMATION AND
APPROXIMATE DEGREE OF SATISFACTION OF USER’S NEEDS**

The important advantage of the Internet network in terms of satisfaction of information requirements is the integrative effect—the qualitative growth of the information content of the environment by virtue of quantitative growth of the resources and the specific nature of the Internet contributing to the processes of self-organisation. The indicated property results from the globalisation of the Internet, which is of the switch over (starting from a certain level of information content) to functioning as a single and interconnected whole. According to G. Atoyán and E. Kagan (Atoyán, Kagan, 1997), “in the process of functioning, an interaction between the virtual systems both at the level of horizontal, and at the level of vertical hierarchy, occurs in the Network. But if the interaction at the level of horizontal hierarchy does not result in any qualitatively new effects, then the interaction between the systems located

at different levels of vertical hierarchy shall be accompanied by the effect of “generations of meanings”. ... In so doing, the “meaning” generated in the process of interaction cannot be described by the terms of any other system generating such meaning, nor can it be predicted proceeding from their behaviour”.

In the field of supply of information on education via the Internet, such processes have resulted in the appearance and development of a great number of meta-sites—information systems of different levels and types supporting the information processes in the field of education.

The **information processes in the field of education** is understood to be the processes of collection, processing, accumulation, storage, search and distribution of the information in the field of education.

In this context, **the information system in the field of education (ISE)** shall be defined as the organisationally ordered set of documents (files of documents) and information technologies (including the Internet technology), realising the information processes in the field of education.

The main contents of ISE shall be **the information resources**—separate documents and separate files of documents, software and other non-textual materials (graphic, audio and video), presented both as a part of their own ISE structure, and (indirectly) as a part of other information systems (libraries, archives, funds, databanks).

The means of ISE support shall be used for designing and operation of ISE, including the program, technical, linguistic, legal, organisational facilities (software products; computer and telecommunication equipment; dictionaries, thesauruses and qualifiers; instructions and techniques; rules, charters, duty regulations; circuits and their descriptions and other operational and accompanying documentation).

3.1. Main types of information systems on education and their functional features

Fundamental mechanisms of information systems operation

The mechanism of operation of the information systems shall be based on:

- the integration of previously separated data (historical archives, data of operating systems, public data) within a single warehouse, their indexing, and co-ordination and, may be, aggregation;
- physical separation of the units where the operating systems are realised from the unit where the data are subject to analytical treatment.

Thus, the information obtained from the data sources shall be extracted, subject to primary treatment (transformation) and loaded into the warehouse of the data presented in an indexed form (with the aid of the metadata) for further treatment either in the operating mode (OLTP), or in the analytical mode (OLAP) (with respective program and technical tools) (see Fig. 3).

The architecture client/server providing better service for a smaller charge shall be selected for the creation of the system of decision-making support with the warehouse of data. The data warehouse shall be based on the relational database management system (DBMS), which shall be used for

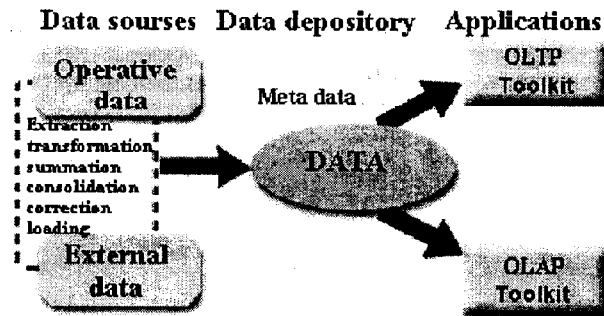


Fig. 3. Principal mechanism of operation of ISE

accumulation, integration and maintenance of business information retrieved from the operating Database.

Basic types of information systems on education

In accordance with the type of information procession

The following two basic complementary directions of the development of information systems (IS) have always existed in the field of creation of information technologies: the systems oriented toward operative processing or, to be more exact, "treatment" of data, and the systems designed for analytical work with the information. Both types of the systems access the data warehouses for fulfilment of their functions.

Warehouses of data (data warehouse, DWH)—database containing pre-processed initial ("raw", "operational" etc.) data. The objective of the processing is to make the data suitable and convenient for analytical use by different classes of users, at the same time preserving the information density of the basic data (Przhiyalkovskiy, Dictionary of Database. Control systems of Databases #4/96).

On-line IS—systems of on-line processing of transactions (OLTP, On-Line Transaction Processing). The information retrieval system working with DWH in the mode of real time is an example of IS. The users of such systems may be referred to as operators.

Analytical IS—systems designed for problems of analysis (OLAP, On-Line Analytical Processing) and support of decision-making (DSS, Decision Systems). The analysis problems include the realisation of scientific researches for working out from recommendations, management decision-making etc. The automated data processing in a real time mode is impossible for these systems because of:

- the large formal uncertainty of objectives and the subjectivity of criteria for the valuation of adopted decisions;
- the availability of obvious elements of an intuitive character in the information-analytical technologies;
- the essential influence of the deviation processes on the preparation and adoption of administrative decisions (Raykov, 1995).

The documentary and information-analytical centres (clearinghouses, CH) integrate all of the indicated types of IS, that allows them to collect, process, accumulate, store, search, analyse and distribute the information.

In accordance with the ISE structure

Centralised ISE shall be applied when the sphere includes a large number of users working with the shared information and connected to a central computer or an integrated network. Numerous transactional systems and external sources fill the content of the centralised information warehouse. As an example of such ISE, one may present the Education World ISE (<http://www.education-world.com/>), which on a centralised basis contains more than 110 000 units of storage.

Distributed ISE shall be applied by large organisations with a large number of distance branches being autonomous decision-making centres. The national system of education is exactly such an organisation. In this case, the branch ISE—DM (data mart, “an information display”) shall be opened for each of the administrative and educational levels as a separate database which copies from the central warehouse only the information which is required specifically for such branch. The ERIC (Educational Resources Information Center) (<http://www.accesseric.org:81>)—national information system of the USA originally designed for providing the users with access to the files of educational literature, now providing a great variety of service and information products on a wide range of questions related to the field of education shall be an example of such IS on education via the Internet. It consists of 16 target-oriented regular documentary (Clearinghouses) and information-analytical centres, associated extra centres (Adjunct Clearinghouses), a number of auxiliary components (Support Components) and publishing centres (Publishers), software-united by an integrated indexed database.

In accordance with the types of organisations holding ISE and their objectives

The specificity of construction of a certain ISE to a large extent depends on the objectives of organisations holding ISE. A possible classification based on these criteria and on the proposals of B. Shneiderman (Shneiderman, 1998) is presented below:

Table 7

Types of organisations holding ISE and their objectives

ISE objectives	Types of the organisation—holder ISE
Advertising and sale of information products	Publishing and information-analytical centres
Information on programmes, measures and announcement of events in the field of education; advertising of educational services	Educational Institutions, museums, municipal authorities
Provision of access to information resources	Libraries, periodic editions, scientific organisations
Information support for the system of decision-making in education management	Governmental bodies on education
Initiation of public discussions	Interest groups, journals
Organisation of network communities	Professional associations in the field of education

Placement of ISE in the WWW environment

It should be noted that the majority of information systems are currently based on WWW technologies.

WWW (World Wide Web), according to A. Franc (Franc, Services the Internet. The LAN/journal of the NETWORK DECISIONS #05/96) is a customer-server system of representation of information in the hypermedia form. The Web environment is presented by a hypertext mark-up language (Hypertext Mark-up Language, HTML).

HTML is a language of description of pages, which shows a PC user, how to display the text and graphics contained in a Web unit.

The program of Web viewing (Web-browser) is an HTML interpreter. The Web-browser requests and obtains HTML-coded documents from the Web server and displays the information in compliance with the HTML commands contained in the code.

The placement of the information systems in the WWW has both advantages and disadvantages, most of which are presented in the Table 8 (in accordance with N. Raden. Integration of the WWW and information warehouses http://www.sibinfo.ru/~buka/dwh/www_dwh.htm).

Table 8

Advantages and disadvantages of placing ISE in the WWW environment

Advantages	Disadvantages
Solution of the problem of incompatibility of program platforms	Difficulties of integration the WWW with corporate databases
Simplicity of creation of distributed ISE	Absence of reliable means of protection of the data
Reduction of costs and reduction of time in developing the interface due to the use of uniform standard Web-browsers	Relative non-determinacy of the interaction between Web-server and Web-browsers
Opportunities provided by the WWW for transfer of multimedia	Difficulty of visualisation of data because of low throughput capacity

Interaction between ISE and the user: main types of interface

The use of metaphors borrowed from the practice of the non-numerical circulation of information is quite a productive approach to the description and designing of information systems. So, the "bookmarks" and "browsing of pages" (paging) marks have become universally recognised on the WWW. In the field of description of the interfaces in Web-based information systems one may present a number of metaphors, which well describe possible structures for interaction between the systems and the user (Shneiderman, 1997) (as the complexity grows) (see Table 9).

One should add that some of the metaphors serve not only to describe the algorithm of the user actions in the process of searching and obtaining the information, but they also give a visual representation, down to the creation of virtual worlds with the interface three-dimensional visualisation.

Metaphors representing main types of ISE interfaces

Metaphor	Type of the ISE interface
The documents package (folder)	The Web-page with references to separate files for network viewing or loading
The book divided into chapters	The textual material with HTML marking
The encyclopaedia containing articles located in alphabetic order	The catalogue with references to other Web-pages where target documents are presented
The museum with a number of expositions	The sequence of Web-pages with multimedia presented by objects
The supermarket with shops	The complex structured site with a route designed for filling and sending of personalised forms to the server
Telecasting via channels	The dispatch of information (Internet- broadcasting) using push- and pull-technologies
The city with bridges, roads, buildings and specific relief	The distributed information system

Ergonomic characteristics of ISE: usage of built-in cognitive strategies

Taking the significant volumes of information into account, which can contain ISE and diverse types of interfaces, which are sometimes quite complex in terms of structure, the use of modern technologies of optimisation of presentation of the information for the user, the optimisation of the system ergonomic characteristics become especially important for the ISE. In terms of its nature, this function is the subtask of the ISE educational function.

The authors of the report "Report on the Effectiveness of Technology in Schools, 95-96" (Report on the Effectiveness...) single out the following **types of built-in cognitive strategies:**

1. The repetition and rehearsal of contents.
2. The paraphrasing.
3. The selection of separate parts (blocks) of the information.
4. The underlining.
5. The use of cognitive cards or diagrams.
6. The identification of analogies and interrelations.
7. The application of illustrating examples.
8. The special processing of text for simplification of reading.
9. The use of icons.

The majority of the indicated types of cognitive strategies also apply to the method of presentation of information and organisation of the ISE interface.

Main functions of information systems on education

As mentioned above, the ISE is not just a meta-resource, but it also has a specific content which cannot be reduced to other types of resources, and,

therefore, presents an independent type of Internet-application in the field of education. Moreover, the ISE, being saturated with data and highly organised, are included as universal systems into all three types of educational activities. In this respect, the ISE is based on **the research-information function** being a part of the research-methodical work in the field of education. ISE also directly performs an **educational function** assigning within its composition a specialised component teaching the users the methods and techniques of work both directly with ISE, and in the Internet as a whole. In the end, in performing the **information-organising function** the ISE acts as a manager administrative system in relation to the network communities of different types.

Opportunities provided by information systems on education via the Internet (ISE) in the context of tasks and functions of UNESCO

The types of the information service provided by the ISE in the field of education give opportunities for a more complete realisation of the main functions of UNESCO.

So, the ISE provides a kind of a proving ground for development of new information technologies of education for the support of **promising research** in the field of education.

The activity on development, distribution and exchange of knowledge is as well supported by the ISE—both as a source of the information for research work, and via the support of mechanisms of exchange of advanced experience and functioning as a training system for the members of educational communities.

ISE can perform functions of a database providing opportunities for a comparative analysis of national standards and act as the mechanism of distribution of this type of information for support **UNESCO activities in the development of international standards in the field of education.**

The expert activity of UNESCO in the field of education can be supported by ISE through the organisation of co-operation between distributed groups of experts on the Internet.

The exchange of specialised information on education is a most direct task of ISE.

It is important to emphasise that the main research-information function of the ISE adequately complies with one of the main tasks of UNESCO provided for by the Mandate on activity in the field of education for the years 1998 and 1999, authored by the Deputy General Director (Education), Mr. Colin Power. The second task, which can be directly supported by ISE, is to provide more opportunities for education of social groups in some countries and regions currently facing discrimination in this respect (poverty-stricken population, youth, women and children). Contributing to the educational services and resources in the Internet, the ISE can contribute to the achievement of the main objective of UNESCO—“to contribute to peace and security by promoting collaboration among the nations through education, science and culture”.

3.2. Data in the information systems on education: main types, mechanisms of obtaining and description, criterion of quality evaluation

Types of information on AIE

The information systems on education offer a variety of types of information, but for the purposes of this survey the information on the Internet applications on education—AIE descriptions—is of main interest. The typology of Internet applications on education identified on the basis of the analysis of the research literature and the performed analysis of tasks and achievements in the field of the AIE application make it possible to group all types of the AIE descriptions into a common classification built on the basis of basic typological features adopted in the second chapter of the survey. A list of the types of the AIE descriptions analysed in accordance with the separate classification features is presented below.

In accordance with the types of the described AIE

1. Information retrieval: descriptions of documents, publications, including the ones in electronic form, program and hardware support of teaching, databases; reference materials.

2. Individualising teaching and learning: descriptions of individualised courses, help systems and directories on participants of the educational process and educational institutions.

3. Group teaching and learning: descriptions of educational courses, lectures, and representations of educational institutions in the WWW.

4. Collaborative activities: descriptions of measures in the field of education, group projects of students and teachers, distributed network communities in the field of education.

In accordance with the objectives pursued by the authors of the AIE descriptions

1. Research materials.

2. Reference materials.

3. Information retrieval systems.

4. Advertising materials.

5. Organisation and support of group projects.

In accordance with the levels of the AIE description

1. The information coming from individual persons (teachers and trainees).

2. The descriptions of specific events and measures (educational courses and programmes, measures and projects).

3. The descriptions of separate establishments and organisations related to education (educational institutions and institutes in the field of education, inquiry systems and databases, specific administrative bodies, publishing centres and magazines).

4. The descriptions of regional educational systems (a number of educational institutions of different educational levels, state and non-state organisations in the field of education, distributed educational institutions and organisations of national level).

5. The global level descriptions (international educational organisations, trans-national educational institutions, and the world system of education considered as a single whole).

In accordance with the level of formalisation of the AIE descriptions

1. Informal descriptions of any type.
2. Formalised AIE descriptions in the text with a specified structure.
3. Mathematical and statistical models of systems and objects of education.

In accordance with the degree of structuring of the AIE descriptions

1. Any descriptions.
2. Linear descriptions (alphabetic and other lists).
3. Tables.
4. One-level monothematic catalogues.
5. One-level poly-thematic catalogues.
6. Hierarchical monothematic catalogues.
7. Hierarchical poly-thematic catalogues.
8. Catalogues of network type—the systems of complex structure with hypertext references.

In accordance with the forms of AIE information presentation

Textual materials.

1. Graphic materials (cognitive and navigating cards, block diagrams).
2. Hyperlinks.
3. Audio- and video-materials (animated reels, video and audio clips).

In accordance with the completeness of the AIE information presentation

1. Lists of AIE names (headers, names).
2. Annotated AIE lists.
3. Full text materials and demonstration models.
4. Full text materials with analytical comments.

In accordance with the periods of time

1. Information on events and processes in a real time mode.
2. Relevant information.
3. Historical and archival data.
4. Announcements of events and measures.

**Indicators and criteria used in the descriptions
of Internet-applications in education**

The following criteria may be singled out as indicators acting in ISE as metadata and most frequently used for the structuring of information on AIE:

Information resources of databases and knowledge (in accordance with the first type of AIE)

1. Subjects.
2. Type of access (paid, limited, free).
3. Full text or descriptive.

4. Textual or including software and multimedia resources.
5. Availability or absence of search system.
6. Types of internal navigation (via an index or systematised catalogue).
7. Opportunity for updating by the user.
8. Mono- or poly- lingual.

Educational institutions (in accordance with the second and third types of AIE)

1. The nationality and community.
2. The source of financing.
3. The legal status.
4. The entrance requirements (for “open” or “closed” types).
5. The degree of co-operation with other educational institutes.
6. The communication channels used

Educational programmes (in accordance with the third type of AIE)

1. The types of experts conducting the programme.
2. The source of financing.
3. The educational level.
4. The level (stage) of realisation—project, experiment, operating programme.
5. The target group (citizenship, sex, age, and educational level).
6. The speciality.
7. The required equipment.
8. The required preliminary knowledge and skills.
9. The types of materials provided by an institution.
10. “The degree of virtuality” of educational materials (ranging from advertising to courses whose components are placed in WWW).
11. The type of communication paradigm.
12. The types of applied methods of teaching.
13. The Internet-applications used

Joint projects (in accordance with the fourth type of AIE)

1. The categories of participants (teachers, methodologists, course developers, managers and combinations of these groups, closed and open).
2. The degree of openness.
3. The level of realisation (local, regional, global).
4. The type of educational activity (educational, research, administrative).
5. The method of management—non-controllable, limited simulation, fixed simulation.
6. Synchronous and asynchronous.
7. The basic technologies and required types of equipment.

Sources and methods of obtaining information for ISE

The ISE is filled with information by various methods:

1. **The search for information on the Internet** (Web-units of Educational institutions, specialised organisations and research establishments) with the use of special software and technical tools and subsequent processing.
2. **The processing of reference literature** of various types (including electronic versions).

3. **The collection of information from organisations and private persons** via various channels (filling the Web-forms, questionnaires and the journal of ISE visitors, sociological interviews on the basis of the ISE, interviewing, accumulation of materials obtained from synchronous and asynchronous teleconferences).
4. **The co-operation and integration** (at the programme, methodical, organisational and other levels) **with other ISE and organisations** being the carriers of information on education (state bodies of management, archives, international organisations).
5. **The preparation of special analytical, survey and methodical materials** both by the ISE employees, and by the invited experts upon the order of the ISE (including those based on the materials placed in the ISE).

Criteria for gauging the quality of information provided by information systems: comparison of traditional and WWW systems

Since the experience in the allocation of information systems on the WWW is not yet big, in developing the criteria for the quality of the information service provided by such systems it is expedient to use the experience obtained in the process of realisation IS traditional (non-numerical) type. A similar approach was offered by J. Retting (Retting, 1996).

The information systems (IS) realised in a printed form—dictionaries, encyclopaedias, directories, bibliographies, atlases etc. present one of the most advanced types of such systems. The comparative table of the criteria of quality of information typical for these kinds of edition and the criteria of the quality of information for WWW-based systems is presented in Table 10 (according to Reference Books Bulletin Editorial Board Manual, 1990, Norman, 1986; Retting, 1996).

3.3. The needs of different categories of persons for information on the usage of the Internet in education

The categories of users interested in the information on AIE

The ISE users can be subdivided into some categories in accordance with various criteria.

In accordance with the “individuality” criterion one may single out the following types:

- individual persons;
- collective users;
- organisations and institutions.

The following are singled out in accordance with educational activity:

- teachers, methodologists and developers of courses, science workers;
- learners and entrants;
- managers of educational institutions, workers of state and public organisations in the field of education.

The information requirements of various categories of ISE users are specific in relation to the types of information on AIE. Taking the classification of the types of information on AIE indicated in the section 3.2 into account, and taking the categories of the users selected in accordance with the educational activity into account, the preliminary analysis of the information requirements of such categories of users has been carried out.

Comparison of criteria for quality of information systems
of traditional type allocated in the WWW

Criterion of quality of information for printed IS	Relevance in relation to Web-based IS
The accuracy	Applicable in relation to any media
The appropriateness for this target audience	The problem of access of some categories of users to specific information is widely discussed
The adequacy of the form of presentation of information (Arrangement)	The critical element in estimation of a Web-resource as valuable and useful
The authority of a source (qualification of authors, editors, publishers)	Applicable in relation to any media
The quality of bibliographic references (Bibliography)	The analogue on the WWW—adequacy and actuality of references (URL)
The comparative value in relation to other resources of a similar type (Comparability)	Underestimated in Web-systems because of the high labour costs
The completeness	Applicable in relation to any media
The value of contents (Content)	Due to the availability of the publication on the WWW this criterion has even greater significance than that of traditional types IS
The specificity of information (Distinction)	Underestimated on the WWW
The adequacy of use of sources of information (Documentation)	Is underestimated on the WWW due to the low culture of the copyright
The durability	Inapplicable
The ease-of-use	More important on the WWW due to its potentials in construction of complex structure systems
The quality of illustrations (Illustrations)	One of most obvious advantages of WWW multimedia
The availability and functionality of catalogue (Index)	Widely used on the WWW, but in so doing it is often poorly systematised (in the hope for hyperlinks functionality)
The target audience (Level)	Applicable in relation to any media
The reliability	Underestimated on the WWW because of availability of publication
The frequency of revision and corrections (Revisions)	The analogue for the WWW—regularity of support (frequency of updating)
The uniqueness	Especially important for the WWW

The results of the analysis are presented in Table 11. This presentation of the information requirements of ISE users allows for evaluating approximately the degree of their satisfaction with the existing ISE; such evaluation has been performed in the following sections (3.4–3.5).

3.4. Analysis of current universal information retrieval systems

IMPORTANT COMMENT. The survey (see below) of existing information systems on the Internet has been performed using of the method of the user's real situations in the field of education. The information systems have received "external" description without processing the documentation presented by the developers and other

Information requirements of ISE users

		Categories of ISE users (according to types of educational activity)		
		The learners and entrants	The teachers, methodologists, developers of courses, research workers	The managers of educational institutions, officers of state and public organisations in the sphere of education
Types of the information about AIE	In accordance with types of AIE	The publications, including the ones in the electronic form, description of databases; help materials; descriptions of individualised courses, help systems and directories on participants of educational process and educational institutions; descriptions of educational courses, lectures, representations of educational institutions on the WWW; the descriptions of events in the field of education, the group projects of students.	The documents, publication, including the ones in electronic form, descriptions of software and hardware designed for the support of teaching, databases; reference materials; help systems and directories on participants of the educational process and educational institutions; descriptions of educational courses, lectures, representations of educational institutions in WWW; descriptions of events in the field of education, group projects of students and teachers, distributed network communities in the field of education.	The documents, publication, including the ones in electronic form, description of databases; help materials; directories and directories on participants of the educational process and educational institutions; descriptions of representations of educational institutions on the WWW; descriptions of events in the field of education, distributed network communities in the field of education.
	In accordance with the levels of AIE description	The information coming from individuals (teachers and learners); information on specific events and measures (educational courses and programmes, events and projects); descriptions of separate establishments and organisations related to the sphere of education (educational organisations and institutions in the field of education, directory systems and databases, specific administrative bodies, publishing centres and journals).	The information on specific events and measures (educational courses and programs, events and projects); descriptions of separate establishments and organisations related to the sphere of education (educational organisations and institutions in the field of education, directory systems and databases, specific administrative bodies, publishing centres and journals); descriptions of regional educational systems (set of educational institutions of different educational levels, state and non-state organisations in the sphere of education, distributed educational institutions and organisations of national level); descriptions of a global level (international organisations in the field of education, transnational educational institutions and the global system of education considered as a single whole).	The descriptions of separate establishments and organisations related to the sphere of education (educational organisations and institutions in the field of education, directory systems and databases, specific administrative bodies, publishing centres and journals); descriptions of regional educational systems (set of educational institutions of different educational levels, state and non-state organisations in the sphere of education, distributed educational institutions and organisations of national level); descriptions of global level (international organisations in the field of education, transnational educational institutions and the global system of education considered as a single whole).

Table 11 (continue)

	A In accordance with the level of formalisation of AIE descriptions	The informal descriptions of any type; formalised descriptions of AIE in the text with a set structure.	The formalised descriptions of AIE in the text with a set structure; mathematical and statistical models of systems and objects in the sphere of education.	The informal descriptions of an any type; formalised descriptions of AIE in the text with a set structure; statistical models of systems and objects of sphere of education.
	In accordance with the degree of structuring of the AIE descriptions	any descriptions; linear descriptions (alphabetic and other lists); tables; single-level mono-thematic catalogues; single-level poly-thematic catalogues; hierarchical mono-thematic catalogues; hierarchical poly-thematic catalogues; catalogues of a network type—complex structured of system with by the hyperlinks.	linear descriptions (alphabetic and other lists); tables; hierarchical mono-thematic catalogues; hierarchical poly-thematic catalogues; catalogues of a network type—complex structured of system with hypertext references.	any descriptions; linear descriptions (alphabetic and other lists); tables; single-level mono-thematic catalogues; single-level poly-thematic catalogues; hierarchical mono-thematic catalogues; hierarchical poly-thematic catalogues; catalogues of a network type—complex structured systems with hypertext references.
	In accordance with the forms of presentation of information on AIE	The textual materials; Graphic materials (cognitive and navigating cards, block diagrams); Hyperlinks; audio- and video-materials (animated reels, video and audio-clips).	The textual materials; Graphic materials (cognitive and navigating cards, block diagrams); hyperlinks; audio- and video-materials (animated reels, video and audio-clips).	The textual materials; Graphic materials (cognitive and navigating cards, block diagrams); hyperlinks.
	In accordance with the time periods	The information on events and processes in a real time mode; The urgent information; announcements of events and measures.	The information on events and processes in a real time mode; The urgent information; The historical and archival data; announcements of events and measures.	The information on events and processes in a real time mode; The urgent information; The historical and archival data; announcements of events and measures.
	In accordance with permissible labour costs	Minimum	High	Medium

service materials. Besides, all descriptions have been made in an on-line mode in the Internet, under the conditions, which in principle cannot be displayed, for control measurement. So, the descriptions presented below cannot be considered as attempts to give a complete representation of functional possibilities and content of such systems. The authors of the survey do not bear any responsibility for the use of the proposed materials for the purposes, which are not specified, in this survey.

The survey works (Keshelava, 1974; Singh and Lidsky, 1996; Computers and Internet; How to use Web search engines; Search Tools—Description and links; Liu; Notes; Garman 1999; Search Engine Features Chart; Search Engine Reviews; Search Tools Chart) describe the most important universal information retrieval systems (IRS) on the Internet. This research considers only the systems with English and Russian interfaces. Table 12 includes 31 systems selected from the surveys and found on the Internet.

Table 12

Universal IRS's

#	Name	URL	Availability of the section related to education (the title of the section)
1.	AltaVista	www.altavista.digital.com	Reference & Education
2.	Anzwers	www.anzwers.com.au	Reference & Education
3.	C/Net Search	www.search.com	Learning
4.	Euro ferret	euroferret.com	—
5.	EuroSeek	www.euroseek.com	Education
6.	Excite	www.excite.com	Education
7.	Galaxy	galaxy.tradewave.com	Education
8.	HI	www.hi.ru	Education
9.	HotBot	www.hotbot.com	Education
10.	Infohiway	www.infohiway.com	—
11.	Infoseek	www.infoseek.com	Education
12.	List	www.list.ru	Science & Education
13.	Look Smart	www.looksmart.com	Reference & Education
14.	Lycos	www.lycos.com	Education
15.	Magellan	magellan.excite.com	Education
16.	MetaCrawler	www.go2net.com	Education
17.	Netscape	www.netscape.com	Education
18.	Omen	www.omen.orc.ru	Education, learning
19.	Open Directory Project	directorysearch.mozilla.org	Education
20.	Rambler	www.rambler.ru	Education
21.	Russia on the Net	www.ru	Science & Education
22.	SEARCH CENTRE	search.centre.ru	Education
23.	SNAP	www.snap.com	Education
24.	Web list	www.weblist.ru	Education
25.	WebCrawler	www.webcrawler.com	Education
26.	Yahoo	www.yahoo.com	Education
27.	Aport	www.aport.ru	—
28.	AU!	www.au.ru	Education
29.	Internet Stars	www.stars.ru	Education & Science
30.	Ulitka	www.ulitka.ru	Jobs & learning
31.	Yandex	www.vandex.ru	—

As a result, 17 systems including the section related to education (Education, Learning, ...) were selected out of all universal IRS's (IRS). The selected systems were analysed in accordance with the following criteria:

- the structure of the sections related to education;
- the opportunity to search in the sections related to education;
- the quantity of indexed servers;
- the quantity of indexed servers in the sections related to education;
- the co-operation with other universal IRS's;
- the opportunity for searching in different languages;
- the topicality of the information (frequency of re-indexing).

The results of the analysis of the selected systems are presented in Table 13. To use Table 13 it is necessary to bear in mind the following:

- **The first** column "Name of IRS (Information Retrieval System)" indicates the names of systems arranged in an alphabetic order.
- **The second** column "Search in section "education"" includes the symbol "+" for the systems providing search facilities inside the unit related to education. The symbol "-" in this column implies the absence of such an opportunity.
- **The third** column "Quantity of indexed documents, if otherwise is not indicated", indicates the number of indexed documents (pages). If the cell of the Table includes "servers", then the number of indexed servers is indicated.
- **The fourth** column indicates the quantity of indexed documents in the section related to education.
- **The fifth** column "Co-operation with other IRS's" indicates the universal IRS to which a request can be re-addressed in case of the absence of a result or upon user instruction. If the column includes the symbol "-", the system does not provide an opportunity for searching in other universal IRS's.
- **The sixth** column "Opportunity to search in different languages" lists languages in which the system provides the information search.
- **The seventh** column "Frequency of re-indexing" indicates the periodicity with which the re-indexing of pages is performed.

The degree of this system's orientation towards the information requirements of the users in the field of education may be judged on the basis of the quantity of respective headers (sub-headers). In this connection, the number of sub-headers for 17 IRS's was calculated for each category of users in the field of education, designed for each category of user. In accordance with the quantity of sub-headers as per each category of users one may get an idea of the **opportunity for satisfaction** by the universal IRS's for the needs of various categories of users.

The final results on all investigated systems are presented in Fig. 4. The quantity of sub-headers on all universal IRS's is indicated for each category of users.

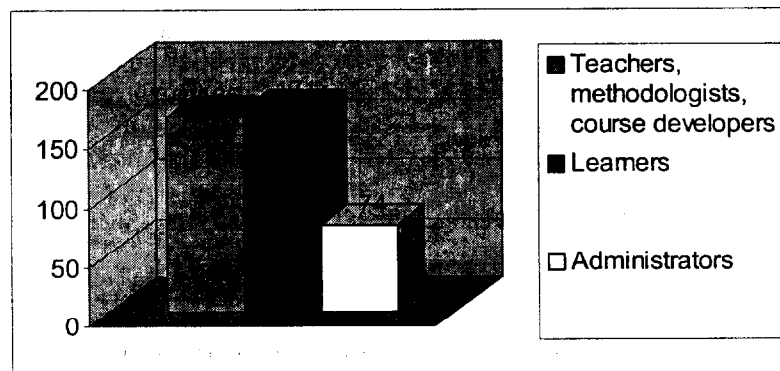


Fig. 4. Quantity of sub-headers for the categories of the users (pieces)

Table 13

Results of analysis of universal IRS's

Name of IRS	Search in the section "education"	Total quantity of re-indexed documents, if otherwise is not indicated	Quantity of documents in the section "education"	Co-operation with other IRS's	Opportunity for searching in different languages	Frequency of re-indexing
1	2	3	4	5	6	7
1. AltaVista	+	150 million	About 2000	-	Chinese, Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hebrew, Hungarian, Icelandic, Italian, Japanese, Korean, Latvian, Lithuanian, Norwegian, Polish, Portuguese, Romanian, Russian, Spanish, Swedish	daily
2. Anzwers	-	no data	-	-	English (information on an opportunity for search in other languages is not available)	1-2 weeks
3. Excite	+	60 million	No data	-	English (information on an opportunity for search in other languages is not available)	weekly
4. Galaxy	-	no data	No data	-	English (information on an opportunity for search in other languages is not available)	no data
5. HotBot	-	110 million	No data	-	Dutch, English, Finnish, French, German, Italian, Portuguese, Spanish, Swedish	weekly
6. Infoseek	+	about 60 million	No data	-	English (information on an opportunity for search in other languages is not available)	in case of change of a page
7. List	+	23000	2079	-	Russian	no data
8. Look Smart	-	800000	No data	-	English (information on an opportunity for search in other languages is not available)	no data
9. Lycos	-	50 million	No data	Search is possible in HotBot	English, French, German, Dutch, Danish, Finnish, Gaelic, Icelandic, Italian, Norwegian, Portuguese, Slovenian, Spanish, Swedish, Welsh	2-4 weeks
10. Magellan	-	no data	No data	Search is possible in Excite	English (information on an opportunity for search in other languages is not available)	3-4 weeks

1	2	3	4	5	6	7
11. Netscape	-	345000	no data	Search is possible in Infoseek, Lycos, SNAP, LookSmart, Excite	English (information on an opportunity for search in other languages is not available)	no data
12. Open Directory project	+	398587 servers	4735	Search is possible in: AltaVista DejaNews EuroFerret EuroSeek Excite Google GoTo HotBot Infind Infoseek Lycos MetaCrawler Netscape Northern Light WebCrawler Yahoo	English (information on an opportunity for search in other languages is not available)	no data
13. Rambler	+	19000	650	-	Russian	no data
14. Russia on the Net	+	about 500 links	no data	-	Russian	no data
15. SNAP	+	about 99 million	no data	-	Dutch, English, Finnish, French, German, Italian, Portuguese, Spanish, Swedish, Russian	no data
16. WebCrawler	-	2 million	no data	-	English (information on an opportunity for search in other languages is not available)	2 weeks
17. Yahoo	+	more than 1 million	More than 6000	Search is possible in AltaVista	English (information on an opportunity for search in other languages is not available)	no data

From Fig. 4. one may see that the universal IRS to the least extent provides for sub-headers for the administrative officers. Most of the sub-headers are provided for learners. Out of the 17 indicated systems only 9 allow performing of a search in the section related to education. These systems are indicated in Table 15. The second column "Quantity of re-indexed documents, if otherwise is not indicated" includes the data from the third column of Table 14. The systems in Table 15 are ordered in accordance with the volume of data.

Table 15

Universal IRS's allowing the performing of a search in the section related to education

#	The title	Quantity of re-indexed documents (if otherwise is not indicated)
1.	AltaVista	150 million
2.	SNAP	about 99 million
3.	Excite	60 million
4.	Infoseek	about 60 million
5.	Yahoo	more than 1 million
6.	Open Directory project	398587 servers
7.	List	23000
8.	Rambler	19000
9.	Russia on the Net	about 500 references

Five test inquiries have been performed in the first six systems (AltaVista, SNAP, Excite, Infoseek, Yahoo and Open Directory project) of Table 2.3 (the biggest) for **determination of the resources** in the sections related to education. Three words belonging to the education field ("education", "learning" and "teaching"), that are typical for **education in general** were used for the test inquiries. The quantity of answers per each request is presented in the Figure 5¹. The figures in the Table indicate the quantity of answers per each request. The inscriptions "education", "learning" and "teaching" indicate the diagram sets corresponding to these words. The inscriptions "AltaVista", "SNAP", "Excite", "Infoseek", "Yahoo" and "Open Directory project" indicate the diagram sets corresponding to such IRS's.

The Figure does not represent the results from the SNAP system for the following reasons. In answer to the word "education" SNAP offered around 500 resources, which included sites and separate documents. Besides, some of the documents were repeated.

Fig. 6 indicates the total valuation of the Information Retrieval SYSTEM based on the results of the test inquiries, from which one may see that most of the answers to the common terms in the field of education were given by the systems Yahoo, Infoseek and AltaVista. A much smaller number of answers were given by the Excite and Open Directory project. For valuation of the **degree to which** the Universal IRS's satisfy the information requirements of various categories of users, inquiries were performed in the sections related to the education in the selected universal IRS's (AltaVista, SNAP, Excite, Infoseek, Yahoo, Open Directory project). The inquiry characteristic for each category of the users was simulated. The

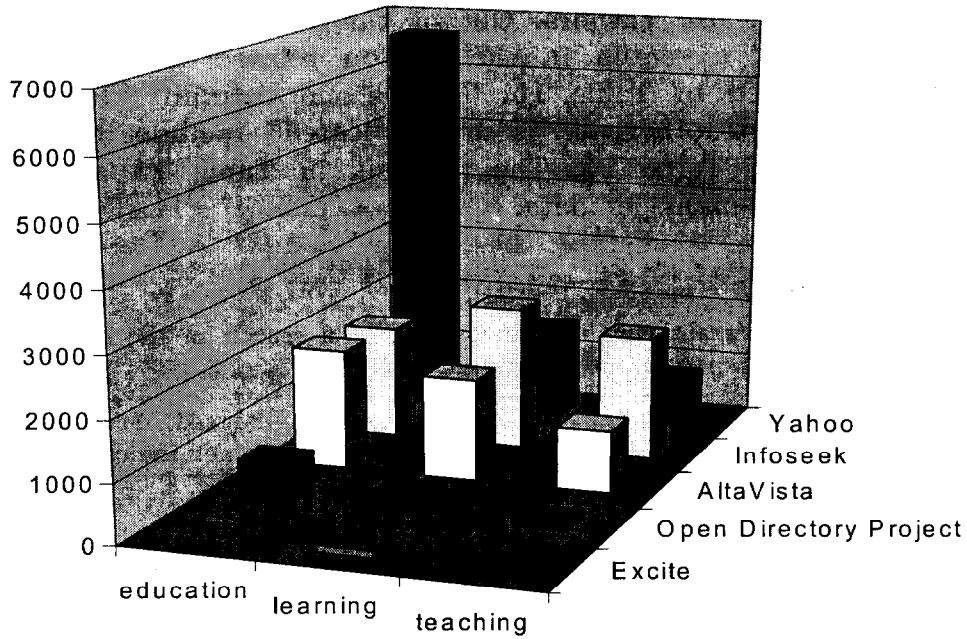


Fig. 5. The results of the test inquiries in accordance with the terms typical for the education field

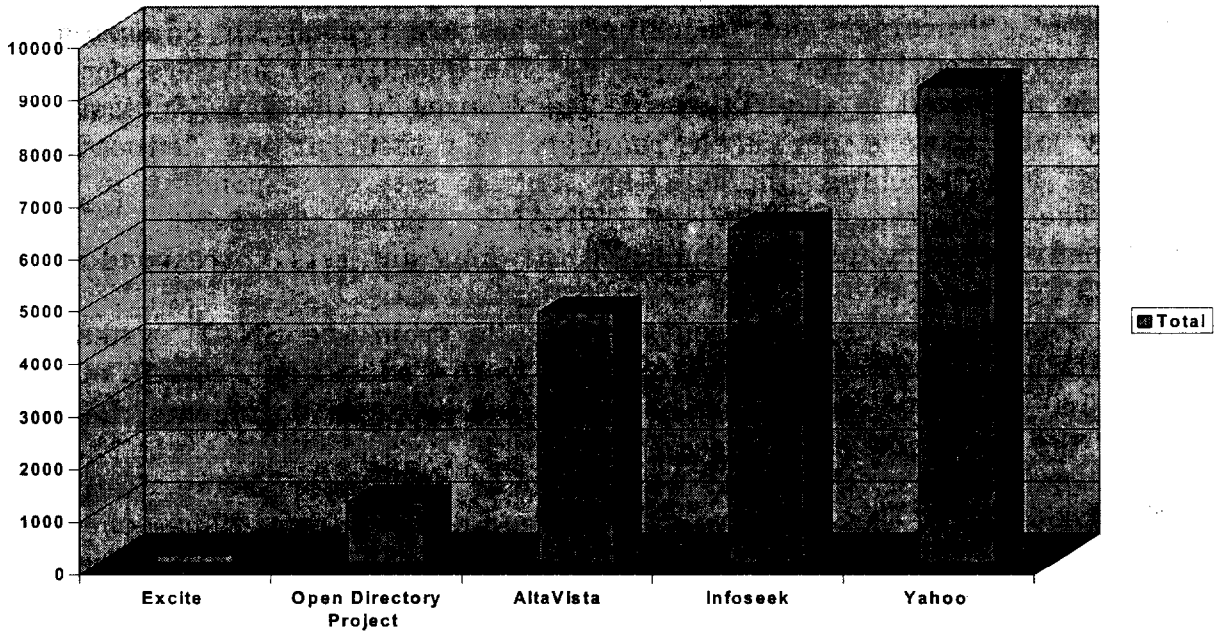


Fig. 6. The total valuation of the Information Retrieval SYSTEM based on the test inquiry results

inquiries were performed in each of the five systems. The results of the testing are presented in the Fig. 7. The quantity of relevant answers to the inquiries was determined as a percentage per each category of user. Only the answers on the first page were analysed, because the relevance of the answers on the following pages is less. The quantity of answers on the first page of the result was assumed to make hundred percent.

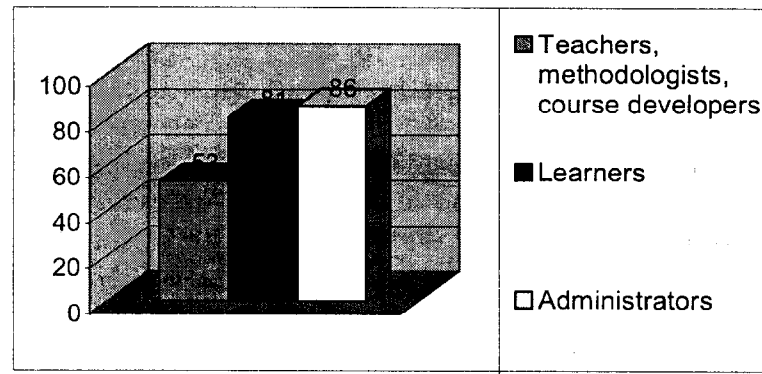


Fig. 7. Number of relevant answers in accordance with the categories of users (%)

From the Fig. 7. one may see that the Universal IRS's are to the least extent adapted to the search inquiries of the teachers, methodologists and developers courses. The largest quantity of relevant answers was given to the inquiry characteristic for the administrative officers. A search in accordance with the names of resources was performed in the Universal IRS's so as to check the **possibility to search for resources** on education via the Internet. The resources related to the category of the ones frequently requested by a wide range of users were selected out of the Internet resources on education (learners, teachers, methodologists, developers of courses and administrative workers). The quantity and the share of obtained resources (as a percentage) were determined for each system. The quantity of resources that we searched for was assumed to be one hundred percent. The results of the test are presented in Fig. 8.

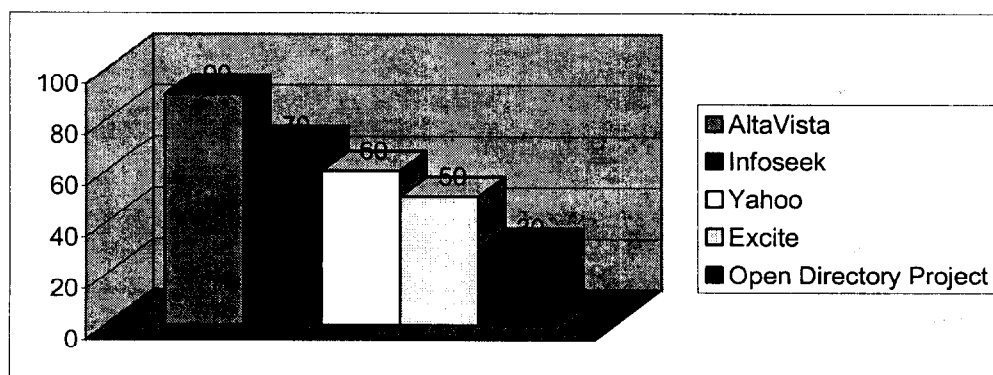


Fig. 8. The share of resources (%) found in accordance with the name in different IRS's

From Fig. 8. one may see that in spite of the fact that some resources were found (the best result was given by the system AltaVista (90% of

resources), one may conclude that it is possible to use the Universal IRS's for the search of resources on education, but, in so doing, the result considerably depends on the chosen system. In working with the Universal IRS's the experience of the user and the level of his/her education (the knowledge of the language of the inquiries in a used Universal IRS) has greater importance.

Conclusions

The results of the analysis allow us to conclude that the support of the administrative workers by information resources on education in accordance with the criterion of availability of easy-to-access resources (availability of respective sections for the administrative workers) is insufficient, but in accordance with the criterion of the quantity of relevant answers to the inquiries characteristic for the administrative workers the Universal IRS's can better meet the requirements of the administrative workers, than that of other categories of users.

The next conclusion is that the result of the search for resources on education in the Universal IRS's considerably depends on the selected system. In so doing, the selection of a system with greatest volume of resources on education does not mean that such a system contains more resources on each sphere of education, than any other system. Also, it is impossible to evaluate the efficiency of the search for resources in accordance with a name through the whole volume of resources on education in a system. This is proved by the results of searches presented at in Fig. 8.

From the above comments one may conclude that among universal systems it is impossible to single out a system which better suits the purpose of searching for resources on education. In other words, to obtain an optimum result it is necessary to use better systems (for example, AltaVista, SNAP, Excite, Infoseek, Yahoo and Open Directory project) and to generalise the results of the search, which is unacceptable for the majority of Internet users.

The generalised conclusion focuses on the fact that one cannot use only universal IRS's to search for educational resources. To obtain better results it is necessary to use a specialised information system on education along with the Universal IRS's, that is analysed below.

3.5. Analysis of current specialised information systems and databases on education

The survey works (see the list of the reference literature) describe the most important specialised information systems on education via the Internet. The objective of this survey is not just the creation of a comprehensive list and complete description of such systems, but to identify the specific features of functioning, informative content and user's characteristics of the main types of such systems. This survey considers only the systems with English and Russian language interfaces. Table 16 presents the systems selected from the indicated surveys and found in the course of the search in the Internet.

The selected systems were analysed in accordance with the following criteria:

- the structure of sections and particular features of the contents;
- the categories of users for which the information is given;
- the possibility of grouping resources in accordance with categories of users;
- the possibility of grouping resources at educational levels;
- the possibility of grouping resources at educational levels within a group in accordance with the categories of the users and vice versa;
- the types of information service;
- the volume of information;
- the availability and functionality of the search system;
- the co-operation with other ISE's.

The Table 16 presents all analysed systems arranged in alphabetic order with their brief description, including the brief characteristic of the system, specific features of the contents and structure of the main sections. One should bear in mind that these systems have been created by organisations of a various types: governmental, educational, commercial etc.

The results of the comparative analysis of the above-indicated specialised ISE's are presented in the Tables 17.1 and 17.2.

The first column "Name" indicates the name of the system. Table 17 fully complies with Table 16 for the sub-items numbers and the name of the system.

The second column "Categories of users for which the information is provided" includes the categories of users who will find there the information complying with their information requirements.

The third column "Opportunity for grouping of resources in accordance with categories of users" includes the categories of users for whom the system provides for respective sections with information resources, or the language of enquiry of a search subsystem allowing the selection of information resources for a certain category of users from the system database.

Columns 2 and 3 use the following abbreviations for designation of the categories of users:

- T—teachers;
- M—methodologists;
- A—administrative workers;
- E—learners;
- D—developers of courses.

The fourth column "Opportunity for the grouping of resources in accordance with educational levels" includes the educational levels for which the system provides for respective sections with information resources, or the language of enquiry of a search subsystem which allows selection of information resources for the educational level from the database of the system. The codes of educational levels of the International standard classification used by UNESCO for education are used for the designation of educational levels:

- Level 0: **education preceding the first level** (pre-school education);
- Level 1: **education of the first level** (elementary education—the first cycle of the basic education);

Specialised ISE's

Name/Organisation/URL	Brief characteristics, features of contents and description of structure (if it is important)
1	2
1. AskERIC / Educational Resources Information Center / www.askeric.org	Specialised Internet system on education issues designed for teachers, librarians, and administrative workers. The main components of the system: · Referral service (user has an opportunity to ask a question, and the founders of the site promise to give an answer during 2 working days) · The virtual library (contains the references to educational sites, sites of libraries, governmental information sites, reference to search systems, syllabus, calendar of conferences, references to published and television materials) · Database on educational articles.
2. BECTa / British Educational Communications and Technology agency / www.becta.org.uk	BECTa is a controlled executive NDPB serving the needs of the UK as a whole. It is a company limited by guarantee with charitable status. Becta's remit is to ensure that technology supports the DfEE's drive to raise educational standards, and in particular to provide the professional expertise the DfEE requires supporting the future development of the National Grid for Learning. · BECTa's Home Page · Feedback · Web Keeper · Information · Projects · Resources · CD-ROM Reviews · Desktop Video Conferencing · The Guide · The Directory · Case Study: · English as a Second Language (ESOL) · FE Resources for Learning (FERL) · Lingua@NET · On-line Bookshop · Special Educational Needs · SENCO Information Exchange · Web links · Organisations · Year 2000 in Education · Support Providers
3. Berkeley Digital Library SunSITE / Copyright © 1999 UC Regents / http://sunsite.berkeley.edu	The library containing the section Teaching and Training, which, in its turn, contains references to various publications in the field of education.
4. Bilingual Education Resources on the Internet / University of Texas at Austin / www.edb.utexas.edu/ coe/depts/ci/bilingue/ resources.html	The page contains references on governmental establishments, journals and publications, research projects, schools and on-line projects.

Table 16 (continue)

1	2
5. Blue Web'n Learning Sites Library / Pacific Bell / http://www.kn.pacbell.com/wired/bluewebn	Library of references to educational sites. References are classified in accordance with the fields of knowledge and allow to receive information on: <ul style="list-style-type: none"> · Teaching aids · www activity · Projects · Curriculum · Hotlist · Other Resources · Reference & Tools.
6. Center for Media Education (CME) / The Center for Media Education / http://tap.epn.org/cme/index2.html	National American non-commercial organisation created for improvement of the quality of mass media work, especially of the projects related to children and families. The objective of the organisation is to provide support of the interaction via telecommunications and Internets - technologies between learners, through which they may participate in the decision-making on important problems, related to the education.
7. CHEST / CHEST / www.chest.ac.uk	The system designed for support of the system of higher education by software, information, teaching complexes and other information resources. Designed for the users of Great Britain and Ireland.
8. College and University Home Pages – Alphabetical Listing / Christina DeMello / http://www.mit.edu:8001/people/cdemello/univ.html	The site contains alphabetic catalogue on references to home pages of educational institutions (more than 3000 institutions); the site indicates universities and colleges of 80 countries worldwide. The site as well contains references to similar systems.
9. College View / The Power Students Network / www.collegeview.com	Effective search system on universities, colleges, administrative establishments of USA and Canada. Apart from the search opportunities, provides a number of virtual tours on schools, references to the projects of universities and colleges, information on co-operation, Message board, chat, provides an opportunity to send questions to an expert.
10. CollegeNet / Universal Algorithms Inc. / www.collegenet.com	The system on universities, colleges, administrative establishments of USA and Canada, Africa, Europe. Structure: <ul style="list-style-type: none"> · References to the projects of universities and colleges. · The information on co-operation, · Message board , chat · Information resources · Search · Questions to an expert.
11. Edex Internet (NETworking for Education) / Internet Network Services Ltd. / www.edex.net.uk	The site covers the events, news in the educational system of Great Britain. The site contains the catalogue on educational resources (Curriculum , information on schools, colleges, universities and official government agencies)
12. Educast / Davidson & Associates / www.educast.com/html/cindex.html	The educational network designed for teachers and administration instantly providing the latest news of the network to the users who installed it at their computers. The services may be adapted to specific users.

Table 16 (continue)

1	2
13. Education and Internet / Iwamizawa Campus, Hokkaido University of Education / http://m.iwa.hokkyodai.ac.jp/ education/internet	Japanese site on education via the Internet. The site presents examples of the use the Internet in education. A few real Internet-projects, TV conferences, examples of the use of satellite communication.
14. Education Home Page / Page by S.Sadi Seferoglu / www.columbia.edu/~sss31/ Education/	Structure: <ul style="list-style-type: none"> · General resources · Use of technologies at schools · Professional resources · The special educational references · Databases on home pages of educational and educational organisations · The list of publications · Conferences and exhibitions · Search of employment · The survey on discussion groups · The survey of search systems
15. EDUCATION index / CollegeView / www.educationindex.com	Education Index, an annotated guide to the best education-related sites on the Web. They are sorted by subject and lifestage. The structure of the site: <ul style="list-style-type: none"> · Subject (Agriculture, Anthropology, etc.) · Lifestage · Prenatal and Infant · Pre-school · Primary Education · Middle Education · Secondary Education · College Education · Distance Learning · Graduate Education · Continuing Education · Parenting · Careers · Weasel World · News
16. Education Supersite / The Education Supersite / http://www.petersons.com	The information-educational site designed for organisation of information on educational technologies for all educational levels allows performing a search of the information necessary to the user in the databases of the system. Structure: <ul style="list-style-type: none"> · Explore Colleges and Universities · Pursue Graduate Programs · Investigate Study Aboard Programs · Find a Summer Camp, Program, or Job · Select Private School · Find a Job · Search Executive Education Programs
17. Education World / American Fidelity Assurance Company / www.education-world.com	The specialised system on the world educational resources, the system includes a database containing more than 100000 references to various information resources on education. The database is well structured and has quite powerful search system. One of its advantages is the availability of the help, as well as an opportunity for exact of the request (on age of the references, on an educational level of the user, Opportunity for a conclusion of the brief description of the system).

Table 16 (continue)

1	2
	<p>The structure of the site:</p> <ul style="list-style-type: none"> · Editorial · What's New This Week? · Lesson Planning · Curriculum · Books In Education · Administrators · Financial Planning · Education Site Reviews · Cool School of the Week · Search engine · Education Topic · Advanced Search · Education Employment Listings · Features · Education News · Headline News · World Resources Center · World School Directory · Education Events Calendar · Message Boards · Awards and Accolades · Support · Contact Us · Help
<p>18. Educational Internet Resources / Home Page by Guy Williams / www.the-spa.com/ guy.williams/main1.htm</p>	<p>Web page Guy Williams, the consultant from the Ministry of Education, the page contains references to educational resources, on-line libraries, educational organisations and programs, exhibitions and museums, school and joint network resources.</p>
<p>19. EDUCAUSE (Transforming Education Trough Information Technologies) / EDUCAUSE / www.educause.edu</p>	<p>Site related to the interests of higher education and information technologies.</p> <p>The structure of the site:</p> <ul style="list-style-type: none"> · Co-operation with other educational systems · Reference information on conferences, seminars, institutes · Publications · Library of information Resources · Discussion groups of Information on co-operation · Employment
<p>20. EDUTECH / TECFA at the University of Geneva, Switzerland Faculty of Psychology and Educational Sciences (FPSE) / agora.unige.ch/tecfa/ edutech</p>	<p>The server of Geneva University. On-line resources for education system and educational technologies support. Includes links at educational servers, which are registered in own database.</p>
<p>21. Eduzone / NYBOR Corporation / www.eduzone.com</p>	<p>The Server is designed for support of the system of education.</p> <p>The structure of the site:</p> <ul style="list-style-type: none"> · Products & Resources · Tips & Handouts · Science & Technology Curriculum K-12 · Scholarships & Grants · School Pages

Table 16 (continue)

1	2
	<ul style="list-style-type: none"> · Educational News · The Bookstore · This Day in History · Calendars · Bulletin Boards · Encyclopaedia Search · Search the Site · About the Eduzone · Links.
22. EduWeb Home Page / http://edweb.gsn.org	The system designed for search of on-line resources related to the problems of education, worldwide.
23. ERIC / Educational Resources Information Center / http://ericae.net/	The ERIC@Clearinghouse on Assessment and Evaluation seeks to provide 1) balanced information concerning educational assessment and 2) resources to encourage responsible test use. Structure : <ul style="list-style-type: none"> · Assessment, Evaluation, Statistics, & Educational Research <ul style="list-style-type: none"> Test Locator Assessment & Evaluation on the Internet Search and explore all assessment & eval sites ERIC & the American Educational Research Association K12ASSESS-L Listserv ERIC/AE On-Line Assessment Library Recent ERIC/AE briefing papers (Digests) How-to series Assessment and Testing in newspapers and magazines An Online, Interactive Computer Adaptive Testing Tutorial · Educational Resources Information Center (ERIC@) <ul style="list-style-type: none"> Track papers presented to ERIC/AE Search ERIC (RIE & CIJE) ERIC System Home page ERIC/AE Staff (pictures) ERIC/AE Education Partners Program Directory of ERIC Resource Collections Submitting documents to ERIC and our Reproduction Release Form.
24. Free-ed.net (Free Education on the Internet) / Free-ed, Ltd. / http://free-ed.net	Free online courses, tutorials, and study guides. There is a classification by fields of knowledge. Structure: <ul style="list-style-type: none"> · Discussion Forum · Guest Book · FAQ · Feedback · About.
25. Global Campus / The Global Campus / www.csulb.edu/gc/	The Global Campus is a collaborative multimedia database containing a variety of outstanding educational materials such as images, sounds, text, and video to be used for non-profit, educational purposes. The goal of the project is to share resources through technology by providing a central "campus" where institutions may make their resources available on the World Wide Web. We provide easy access to high quality materials, which can be used, for instructional development worldwide, while respecting intellectual property rights.

Table 16 (continue)

1	2
26. Global Information Networks in Education / GINIE / http://www.ginie.org/	The objective of Global Information Networks in Education (GINIE) is to improve the quality of education in the countries currently facing the crisis or passing the transitive period for building of stable democracy, creation of progressive market economy and prevention of civil crises. GINIE use the Internet-technology, for organisation of quick access to the information and expert knowledge for the professional workers of education working in the countries facing the crisis or transitive period. Structure: <ul style="list-style-type: none"> · About GINIE · Regions/ Countries · Professional Development Center : · Land Mine Awareness Education · Trauma and Disability Education · Programme for Education for Emergencies and Reconstruction (PEER) · Links to GINIE partners and projects · References · Education Resources · How to Use the Internet · Internet in the Classroom · World Newsdesk · Search · Quick Search by keywords · Details search · Forum · Feedback.
27. Global SchoolHouse / The Global SchoolHouse / http://www.gsn.org	The system contains an alphabetic catalogue of references to the teaching and information resources used at the secondary and pre-school education. The catalogue contains the following resources: <ul style="list-style-type: none"> · Articles · Contents & Competition · Events · Lists · Projects
28. Globewide Network Academy / The Globewide Network Academy / http://www.gnacadey.org/	The Site contains a large catalogue on DE and reference information on books devoted to the DE questions. Includes information on the forum on systems of virtual reality with the built-in MOO programming language. The DE catalogue has quite powerful search system and is also well structured (inquiry may be performed on a header, authors of the course (project), languages, educational level (pre-school, secondary etc.), in accordance with the form of presented information (on-line courses, programs, educational, scientific and research and methodical materials)), that simplifies the user's task on finding required information.
29. GoCollege / GCNet Corporation / http://www.gocollege.com/	Paid information retrieval system providing the following types of service: <ul style="list-style-type: none"> · The search of a college · The search of required educational programs (includes the list of programs in the database) · The on-line test of your knowledge · References to various educational resources · The search on higher Educational institutions · Access to chat.

Table 16 (continue)

1	2
<p>30. Higher Education Consumer's Guide to College Courses on the Internet / A Public Service of Federation of Independent Illinois, Iowa, Minnesota Colleges and Universities. / www.drake.edu/iaicu/consumer_guide.html</p>	<p>The site contains advertising information on educational institutions of the USA offering on-line courses and a number of courses on DE.</p>
<p>31. Homeschooling Information and Homeschool Resources Pages / Home Education Magazine / http://home-ed-press.com/index.html</p>	<p>Server contains information related to out-of-school education. News, articles by competent experts, information resources on support out-of-school teaching.</p>
<p>32. IEARN (International Education and Resource Network) / Institute for Global Communications / www.igc.apc.org/iearn</p>	<p>The international project including educational institutions from 48 countries. Contains information on meetings and conferences, discussion groups, joint projects, database on projects, information on educational resources (article, student's publications, books, video etc.). Database on schools, members of the project.</p>
<p>33. IERC (Internet Education Resource Center) / Hodges & Reed Services, Inc. / www.ierc.com</p>	<p>The advertising catalogue of books, journals, software etc. User-friendly search system (along with an expression one may set a category of a user, a supplier of a product, level of a trainee, subject domain).</p>
<p>34. Interactive Teaching Network / University of Georgia Center for Continuing Education. / http://www.gactr.uga.edu/itn/</p>	<p>Interactive Educational Network designed for experts of general and special education, professional teachers, school administration, school psychologists, parents, social workers, school teachers, learners.</p>
<p>35. Internet Advocate / The Internet Advocate / www.monroe.lib.in.us/~lchampel/netadv.html</p>	<p>The site of information on educational resources for teachers and librarians.</p>
<p>36. Internet Education Group / Internet Education Group, Inc. / www.inet-edu.com</p>	<p>Support of the system of education: Provision of required information for the system of education.</p>

Table 16 (continue)

1	2
37. Internet in Education / Applied Computing Solutions, Inc. / www.applicom.com/famu/ page1.htm	The small site devoted to the use of education in the Internet. Contains some articles and references to educational sites.
38. Internet Special Education Resources / Internet Special Education Resources / www.iser.com	The system is designed for simplification of search of experts in the field of education to provide aid in solution of questions connected with science and education.
39. Japan Co-operation on Internet in Education / www.tile.net:2001/listserv/ eujpedul.html	The list of dispatch of news on education.
40. Kaplan – Web Services / Kaplan Educational Center / www1.kaplan.com	The system providing a variety of educational resources. The site provides the following classification of resources: · Test · Education & Career Goals · Kaplan Information & Services · Job Opportunities · E-Mail Newsletter · Live Courses · Books & Software · Message Boards · Mind Games & Diversions · Customer Support & Suggestion Form.
41. Knowledge Integration Environment / KIE Research Group and the UC-Regents. / http://www.kie.berkeley.edu	The system shall be used in systems of higher and secondary education. Oriented towards scientific support of secondary and higher school.
42. Learning Resource Server / University of Illinois / http://lrs.ed.uiuc.edu/	The system containing references to the projects in the field of education, supported by the teachers and students. Focused on organisation of the process of self-education.
43. Learning Together with the Internet: Teacher and Student Resources / Faculty of Education Queen's University Kingston, CANADA / http://educ.queensu.ca	Use of Internet in education. Structure: · Joint projects and development · Publications (newspaper, books, reports) · On-line Consultations · Use of resources the Internet for on-line classes and projects · On-line discussions.
44. Teaching with Electronic Technology / University of Maryland / www.wam.umd.edu/ ~mihall/teaching.html	The Site containing some references to the information on conferences, publications, and discussion groups covering issues of education in electronic technologies.

Table 16 (continue)

1	2
45. LearntheNet / Michael Lerner Productions / www.learnthenet.com/ english/main.htm	As technology continues to transform the workplace, there is an increasing need for people to understand how to use it productively. Learn the Net focuses on delivering high quality electronic educational products and services to the desktop via the Internet and intranets. Learn the Net.com, a Web-based tutorial for Internet novices and a continuing source of educational and technical assistance for all users.
46. NEA Teaching Learning and Technology / NEA / http://www.nea.org/	The specialised system on teaching and technologies in education. Structure: · Message Board · Education Links · Wired Classroom · Events · Bits & Bytes (News) · Technology Briefs · Ask specific questions about technology
47. NetLearning (Why Teachers Use the Internet) / Songline Studios, Inc. / www.songline.com/teachers	Online Resource Guide. The site contains articles, publications; on-line resources devoted to the question of use of the Internet in education.
48. NODE / The NODE Learning Technologies Network / http://node.on.ca	Non-profit information network facilitating the co-operation and research in the field of technologies for post-secondary education and teaching. Structure: · Client Services · Resources For Practitioners technologies for learning: tfl database tfl topics technology & transformation NODE Publications: LTRreport networking NODE forums Professional contacts upcoming events · Resources For Learners: reference shelf virtual librarian study buddy technology toolkit database of Ontario distance education courses databases of distance education courses world-wide.
49. Online Distance Education Learning Resources / The Online Distance Education Learning Resources (EdSurf) / www.edsurf.net	Selection of addresses at which is possible to obtain free on-line educational service: free courses, software and consultations. Disadvantages: includes no search system, the courses are not classified, that hinders the search of required information.

Table 16 (continue)

1	2
50. Online Internet Institute (OII) / OII / http://oii.org/	The on-line Internet-institute originally designed for simplification of the teachers process of improvement of educational courses on the basis of advanced technologies in education. The system currently operates as versatile, based on the educational standards, assisting the teachers and learners in organisation of educational process.
51. OnlineClass / TBT International, Inc. / www.onlineclass.com	A number of on-line classes for secondary education. The principle of operation of on-line classes see in the appendix.
52. Open University / The Open University / http://www.open.ac.uk/text-only/	The textual version of the site of the open Internet-university. Structure: · Advice · Search · Learning Courses and Qualifications Student experience Research Activity Local advice · Opportunities · Services · Spotlight
53. SchoolWorld Internet Education / SchoolWorld / http://www.schoolworld.asn.au/	Global Internet Classroom designed for the teachers of secondary schools and students. The system contains a set of projects; programs and resources devoted to the problems of education in the secondary educational institutions. The structure of the site: · The syllabus (structured in accordance with the fields of knowledge) · Survey of Online courses · Article and publication · Section "Tek Teachers ", making it possible for the teachers worldwide to be united into groups "of interests" and obtain interesting information via electronic mail. · Catalogue of projects and programs · Search system · Opportunity for registration of a secondary school.
54. Selective Learning Network / Selective Learning Network, Inc / http://roswell.mra-inc.com/sln/	Training (tutor) network engaged in development and research of interactive electronic classes (Electronic Classrooms), on various subject domains. As well, the network contains references to various educational resources. Structure: · Contact SLN · About SLN · Message from the Founder · Announcements (Past & Present) · Archived Classrooms · Electronic Classrooms · SLN Programs · Online Curriculum · Education Links.
55. Study Abroad Directory / Liberty City Promotions, inc. / www.studyabroad.com	Studyabroad.com the on-line study abroad information resource. Here you will find listing for thousands of study abroad programs in more than 100 countries through the world.

Table 16 (continue)

1	2
56. Study WEB / American Computer Resources, Inc. / www.studyweb.com	The alphabetic catalogue of program and information resources in the field of education. The catalogue is classified for fields of knowledge. Structure: · Software Store · The Classroom Internet · Home Work Help Online · Meet Our Faculty.
57. SyllabusWeb / Syllabus Press, Inc. / www.syllabus.com/index.htm	The electronic version of the SyllabusWeb journal containing the information on technologies applied in higher education. Contains articles and publications on technologies of education. As well, the journal provides help information on forthcoming conferences. Includes an opportunity for registration of materials on use of technologies in education for participation in the above listed conferences.
58. Teacherzone / teacherzone.com incorporated. / www.teacherzone.com	Web site contains news and information on educational resources for teachers. The structure of the site: · News and comments · Basis of knowledge (software in the Internet, resources for school web-masters, employment offers, conference) · Examples of on-line classes and specialised systems on educational resources.
59. Teaching with Technology at Penn / SAS Computing / http://ccat.sas.upenn.edu/	The system supporting development of resources for organisation of courses supports discussion groups and electronic class discussions. Structure: · Search CCAT · Internet Guides · Tech Classrooms · Staff, Facilities, and Getting Support · SAS Computer Labs · Mathematics Support · Course Management Tools · A/V Services · Computer Analysis of Texts (CCAT) · Teaching Resources.
60. TENET (The Texas Education Network) / The University of Texas at Austin / www.tenet.edu	The objective of the founders of the site is to make to the search of informative educational resources in the Internet user-friendlier for various categories of users. The structure of the site: · News · Centre of resources (references to libraries, specialised catalogues, and joint projects, educational institutions) · Joining into discussion groups · The information on conferences, forums · The first page of the site includes a starting-point (Jumpstart), allowing to such categories of users as the administrative workers, teacher, parents and students to get immediate access to the sections designed only for such users.
61. Unicor Harvest / Unicor / http://www.unicor.ac.ru/search.en.html	Search system on WWW-servers of higher institutions of Russia.

Table 16 (continue)

1	2
62. University Links / Active Web Networks / http://www-net.com/univ/	The catalogue of various university references, opportunity for search of educational institutions, help of an expert, exist as a references to university forums, the site contains the help page assisting to use system most effectively.
63. Using Technology in Education / ALGONQUIN / www.algonquinc.on.ca/edtech/index.html	The site on use of technologies in education, the site contains: · The articles on technologies in education · The references to systems using new technologies (online courses, journal articles etc.) · The references to search systems (both universal, and specialised).
64. Well Connected Educator / The Well Connected Educator / http://www.gsh.org/wce/choice.htm	On-line centre of publications and forums designed for support K-12. Allows publishing materials, searching required information conducting discussion on educational technologies.
65. Wellspring / The Wellspring (online community of distance education) Collaborative project from Instructional System Inc. And members of the Teacher College, Columbia University / www.wellspring.isinj.com/home.html	The site is designed to give coverage of DE novelties. Contains references to articles, forums, publication, and database on on-line courses.
66. World Lecture Hall / The University of Texas System. / www.utexas.edu/world/lecture/index.html	"World lecture hall" contains references to the pages created by educational institutions using WWW for accommodation of educational materials. The references are united into the alphabetic catalogue and are structured in accordance with the fields of knowledge (anatomy, history, geography etc. (more than 100 names)). Includes an opportunity for interactive registration and inclusions in a database of your rate with the subsequent updating (if it is necessary).
67. Higher Educational Institutions of Russia / Unicor / vuz.unicor.ru	The system of WWW-servers of Higher Educational Institutions of Russia. Designed for fast search of servers of a Higher Educational Institution presenting interest for the user.
68. International Internet – catalogue of information resources of the open educational system / Centre of information And analytical support of the system of distance education (CIAN) of the Ministry of Education of Russia. / catalog.unicor.ru	Poly-lingual catalogue of information resources of the educational system. Contains data on information resources in three languages: working languages of UNESCO (English, French) and the native language of the country of the catalogue accommodation (Russian).

Table 16 (continue)

1	2
<p>69. Pedagogical Internet of Russia / The 'Emissia' Analytical Group / www.emissia.spb.su/ offline/a610.htm</p>	<p>Selection of references chosen out of the registered ones in Russian universal search systems Rambler and Stars, and referred to one of the four categories of resources of Pedagogical Internet of Russia:</p> <ul style="list-style-type: none"> · Information-pedagogical servers; · Sites of pedagogical universities; · Sites of DE establishments; · Sites of centres of information on education.
<p>70. Condition and prospects of development of distance education / CIAN the Ministry of Education of Russia. / de.unicor.ru</p>	<p>Specialised WWW-server created upon the order of the Ministry of general and vocational education of Russian Federation with the purposes of information service of persons and organisations interested in training under the technology of distance education, as well as information and analytical support of employees and heads of higher school on the issues of DE development. This server is intended to help users to obtain more detailed and systematised information on the DE problems. Structure:</p> <ul style="list-style-type: none"> · Calendar of events · DE in the countries world-wide: the main centres · Scientific and research and methodical work in the field of DE · DE Educational institutions · DE Information resources · DE Courses · Russian resources · International resources · Facilities of DE information support · Tool and hardware-software facilities · Telecommunication infrastructure of DE · DE Organisation · International co-operation in the field of DE.
<p>71. Informika / State Research Institute (GosNII) of information technologies and telecommunications / www.informika.ru</p>	<p>Information server of GosNII of information technologies and telecommunications. Designed for user's search of required information on educational organisations, standards, conferences etc.</p>
<p>72. United Nations Educational, Scientific and Cultural Organisation (UNESCO) / http://www.unesco.org/ education/</p>	<p>Site of UNESCO. Structure:</p> <ul style="list-style-type: none"> · Programmes & Activities <ul style="list-style-type: none"> News Educational Materials Current Programmes & Activities Conferences Bureaux, Institutes, Offices Co-operation for Development 50 years for Education · Partners <ul style="list-style-type: none"> IGOs, NGOs, Networks Other Public & Private Partners · Multimedia Library <ul style="list-style-type: none"> E-texts Statistics Catalogues Order Form Education Contact Points Searching our Site · Highlights <ul style="list-style-type: none"> Catalogue of Documents Breaking the Silence Education centre Exclusion Education—a Right or a Privilege?

Table 17.1

Results of the comparative analysis of specialised ISE, which do not give an opportunity for, search of information

Title/Organisation/URL	Category of users for whom the information is given	Opportunity for grouping of resources in accordance with categories of users	Opportunity for grouping of resources in accordance with educational levels	Opportunity for grouping of resources in accordance with educational levels inside a group in accordance with categories of users and vice versa (U→E, E→U, U↔E)	Types of information service	Volume of information (Quantity of references in catalogues on resources on education, quantity of entries in databases)	Search system, Availability and functionality	Co-operation with other IS
1	2	3	4	5	6	7	8	9
4. Bilingual Education Resources on the Internet	E, T, M, D, A	E, T, M, D, A			b, c	Totally about 20 references	-	a
6. Center for Media Education (CME)	E, A	E	-		b, c	About 100 references	-	a, c
8. College and University	E, T, A	-	-	-	b, c	About 3000 references at home pages of educational institutions	-	a
11. Edex Internet	E, T, M, D, A	-	1,2,3,4,5,6	-	a, b, c	No more than 100 references on various educational resources.	-	a, b
13. Education and Internet	T, M, D	T	-	-	a, b, c	About 20 references on examples of use of the Internet in education.	-	a, b, c
14. Education Home Page by S.Sadi Seferoglu	E, T, M, D, A	A	2, 3, 4, 5		a, b, c, d	About 1000 references on various information resources.	-	a, b, c
15. EDUCATION index	E, T, M, D, A	E	0, 1, 2, 3, 4, 5, 6	Unicor→E	a, c	Approximately 3,000 sites in 66 categories.		a
18. Educational Internet Resources	E, T, M, D, A	E	1, 2, 3		a, b, c, d	About 100 references on each section	-	a
22. EdWeb	E	-	-		a, b	About 800 links	-	a
24. Free-ed.net	E, T, M, D, A.	A	-		a, d	About 1000 references	-	a
25. Global Campus	T, E, M, D	-	-	-	a, c	About 250 references	-	a
30. Higher Education Consumer's Guide to College Courses on the Internet	E, T, M, D	-	-	-	b, c	About 15 references to educational institutions	-	a
31. Homeschooling Information and Homeschool Resources Pages	M, T, E, D	-	1, 2, 3, 4, 5		a, b, c	300 references	-	a

Table 17.1 (continue)

1	2	3	4	5	6	7	8	9
32. IEARN	E, T	T	-		a, b, c, d	Search on more than 3000 schools in 50 countries	-	a, b, c
34. Interactive Teaching Network	T, E, M, A				b, c	No data	-	a
35. Internet Advocate	E, T, M, D, A	-	-	-	a	Site contains more than 100 references to information educational resources.	-	a
36. Internet Education Group	E, T, M, D, A	-	-	-	d	A few 100s references, provides access to 1000 syllabus	-	a
38. Internet Special Education Resources	E	-	-	-	b, d	About 100 references	-	a
39. Japan Co-operation on Internet in Education						No data		
40. Kaplan	E, T, M, D	T	0, 1, 4, 5		a, c	About 1500 links		
41. Knowledge Integration Environment	E, T, M, D	-			b, c	About 800 references	-	a
44. Teaching with Electronic Technology	T, M, D, A	T	-		c, d	About 500 references	-	a
45. Learn the Net	E, T	-	-			No data	-	a
47. Net Learning	T, M, D, A	T	-	-	a, d	Approximately 100 articles, and 100 references	-	a
49. Online Distance Education Learning Resources	E, T, M, D	-	-	-	a, c	About 100 references on various free Online rates + free program applications	-	a
50. Online Internet Institute	T, E, M	T		-	a, b, c	About 10 programmes	-	a
51. Online Class	E, T, M, D	-	-	-	c	Currently about 10 classes	-	a
54. Selective Learning Network	T, M, E, D	E	-	-	c, d	About 100 programs, and 100 references on other information resources	-	a, c
55. Study Abroad Directory	E, T	-	4, 5	-	a, b, c	About 1000 references	-	a
63. Using Technology in Education	E, T, M, D	-	-	-	a, b, c	Up to 50 references.	-	a
66. Wellspring	E, T, M, D	-	-	-	a, b, c	About 20 references to fresh information resources.	-	a
69. Pedagogical Internet of Russia	E, T, M, D, A	-	-	-	a, c	About 30 references	-	a
70. Condition and prospects of development of distance education	T, M, A, E, D	-	-	-	a, c	About 70 references to resources on education.	-	a, c

Table 17.2

Results of the comparative analysis specialised ISE, providing an Opportunity for search of the information

Title/Organisation/URL	Category of users for whom the information is given	Opportunity for grouping of resources in accordance with categories of users	Opportunity for grouping of resources in accordance with educational levels	Opportunity for grouping of resources in accordance with educational levels inside a group in accordance with categories of users and vice versa (U→E, E→U, U↔E)	Types of information service	Volume of information (Quantity of references in catalogues on resources on education, quantity of entries in databases)	Search system, Availability and functionality	Co-operation with other IS
1	2	3	4	5	6	7	8	9
1. AskERIC	E, T, M, D, A	E, T, M, D	5, 6	-	a, b, c, d	About 1000 syllabi, more than 950000 publications and journal articles.	+ (F)	a, b, c
2. BECTa	E, T, M, D, A	-	-	-	a, b, c, d	More than 2500 references to educational resources.	+ (F, R, H)	a, b, c
3. Berkeley Digital Library SunSITE	E, T, M, D	T	-	-	A	About 1000 references.	+ (F)	a
5. Blue Web'n Learning Sites Library	T, E, M, A, D	E	-	-	a, c	100 Tutorials, 200 Activities, 50 Project, 200 Lessons, 180 Hotlists, 600 Resources, 200 Refs./Tools	+ (F)	a
7. CHEST	E, T, M, D	-	5,6	-	a, c	About 1000 references	+	a
9. College View	E, T, M, D, A	E, T	4, 5, 6	-	b, c, d	About 4000 references	+ (F, E, G) (some other specific opportunities)	a
10. CollegeNet	E, T, M, D, A	T	-	-	b, c	About 350 links	+	a
12. Educast	T, M, D, A	T	-	-	c, d	About 1000 references	+ (F)	a
16. Education Supersite	T, E, M, A, D	E	1, 2, 3, 4, 5	-	a, b, c	35,000 graduate programs	+ (F, E)	a
17. Education World	E, T, M, D, A.	E, T, M, D, A	1, 2, 3, 4, 5, 6	U↔E	a, b, c	The database contains more than 110000 sites	+ (F, H, E, R)	a

Table 17.2 (continue)

1	2	3	4	5	6	7	8	9
19. EDUCAUSE	E, T, M, D, A	A	5, 6		a, b, c, d	About 1000 references	+ (F)	a
20. EDUTECH	T, M, A, E, D	T, E, D	1, 2, 3, 4, 5, 6		a, b, c	About 500 references	+ (F)	a
21. Eduzone	E, T, M, D, A	E, T,	0, 1, 2, 3, 4, 5, 6	U→E	a, b, c	About 500 references	+	a
23. ERIC	E, T, M, D, A	E, T, M, D, A	1, 2, 3, 4, 5, 6	E→U	a, b, c, d	ERIC's bibliographic database of 850000 + conference papers, reports, instructional materials, research articles, and other materials. 1000 academic libraries and centres world-wide ERIC Digests: 2000 word briefing papers, full text The Directory of ERIC Resource Collections lists 1029 organisations that provide individuals with access to the ERIC database and related resources. Subsystem AskERIC: About 1000 syllabi, more than 950000 publications and journal articles.	+ (F)	a, b, c
26. Global Information Networks in Education	T, M, A, E, D	T	-		a, c, d	>250 documents, about 5000 educational resources	+ (Search of the documents: U, P, A, L, G, F. Search Internet lesson plans, curriculum units and other education resources: E, F, B.)	a, b, c
27. Global SchoolHouse	E, T, D, M	E, T	-		a	About 500 references	+ (F)	a
28. Globewide Network Academy	E, T, M, D	E, T, M, D	1, 2, 3, 4, 5		a, b, c	The catalogue DE contains more than 17000 courses and programs	+ (F, T, I, A, L, E)	a, b

Table 17.2 (continue)

1	2	3	4	5	6	7	8	9
29. GoCollege	E, A, T	T	-	-	a, b, c	Database contains about 500000 educational programs at different educational institutions.	+ (F, G, U)	a
33. IERC	E, T, M, D	E, T	0, 1, 2, 3, 4	U \leftrightarrow E	a	A Thousand names of offered products.	+ (U, T, F, E, A)	a
37. Internet in Education	E, T, M, D	-	-	-	a, c	Up to 10 references to educational sites.	+ (F) Yahoo	a
42. Learning Resource Server	T, E, M, D	-	1, 2, 3, 4, 5, 6		a, b, c,	About 60 references	+ (F)	a
43. Learning Together with the Internet: Teacher and Student Resources	E, T, A	A	-		b, c, d	More than 1500 links	+	a, c
46. NEA Teaching Learning and Technology	T, M, D, A	T	4, 5		a, b, c, d	More than 2500 links	+	a, c
48. NODE	T, M, D, A	T, M, D, A	1, 2, 3, 4, 5, 6	U \rightarrow E	a, b, c, d	10-30 sub-headers in each of the listed sections of the structure. The database "learning technology" contains about 400 technologies. nearly 1200 courses at 14 Ontario universities nearly 1800 courses at 24 Ontario colleges	+ I, (technologies for learning tfl database: T, O, R, C, S. Course Database: F, T, A, G, E, L, R)	a, b, c
52. Open University	T, E, M	E, T	-	-	a, c	About 60 references. The database of courses.	+ (F)	a (***?)
53. SchoolWorld Internet Education	E, T, M, D				a, c, d	More than 1000 links	+ (F)	a, c
56. Study WEB	E, T, M, D, A	T, A	1, 2, 5	-	a, c	About 88 references	+ (F, T)	a, b
57. SyllabusWeb	T, M, A	-	-	-	c, d	More than 300000 articles and editions.	+ (F)	c
58. Teacherzone	T, M, D	T, M	-	-	a, b, c, d	About 1000 links	+ Lycos	a
59. Teaching with Technology at Penn	E, T, M, D, A	T, D, M	-	-	a, b, c	More 500 links	+(F)	a
60. TENET	E, T, M, D, A	E, T, A	1, 2, 3, 4	-	a, b, c, d	About 500 references to various educational resources.	+	a, c
61. Unicorn Harvest	T, E, M, D, A	-	4, 5, 6	-	a, b, c	About 15000 of indexed documents	+ (F, M)	a

Table 17.2 (continue)

1	2	3	4	5	6	7	8	9
62. University Links	E, T, M, D, A	-	1, 2, 3, 4, 5	-	c, d	About 5000 references	+	a, b
64. Well Connected Educator	T, M, E, D	-	-	-	b, c, d	10 sections containing references, each section on the average includes 7-10 references.	+ (F)	a
66. World Lecture Hall	E, T, M, D	-	-	-	a, c	Approximately 10000 articles, courses and programs	+	a
67. Higher institutions of Russia	T, E	-	4, 5, 6	-	a, b, c	More than 600 higher institutions, more than 240 addresses of servers of higher institutions.	+ (G, F)	a
68. International Internet - catalogue of information resources of the open educational system	T, E, M, D, A	-	-	-	a, b, c	More than 1700 information resources	+ (G, I, L, E, F)	a
71. Informika	T, E, A	-	-	-	a, b, c	More than 3000 links	+ (F)	a,
74. United Nations Educational, Scientific and Cultural Organisation (UNESCO)	T, M, D, A	-	-	-	a, b	This trilingual catalogue 1999-2000 contains bibliographical references of documents produced by UNESCO's programmes in the field of education and distributed free of charge. 16 Statistical Graphs 21 Selected Publications on Education 1998-1999 About 100 full-text selected UNESCO Documents on Education UNESCO STATISTICAL YEARBOOK: From the 1998 edition, which contains some 75 tables, we have selected 17 tables and made them available on Internet. VIDEO CATALOGUE - 1999, divided into 40 sections. Each section contains on the average 5 entries.	+	a, b, c

Level 2: education of the second level (secondary education): the education of the first stage of the second level or the second cycle of the basic education;

Level 3: education of the second level (secondary education): the education of the second stage of the second level;

Level 4: the programmes, which are not falling under the second stage of the second level or the third educational level (levels 5 and 6);

Level 5: education of the third level: the programmes of education of the third level, which do not confer any higher research classifications upon graduation;

Level 6: education of the third level: the programs of education of the third level, which are completed with the conferring of higher research classifications.

The fifth column "Opportunity for grouping of resources on educational levels inside the group in accordance with the categories of users and vice versa" indicates that the system provides for the sections for different educational levels inside the sections for various categories of users, or the language of enquiry of a search subsystem allowing the selection of information resources for a certain educational level and certain categories of users from the system database. In other words, respective sections or opportunities of the language of enquiry allowing for group resources in accordance with educational levels and categories of users. The designation "U→E" in this column refers to an opportunity for grouping of resources on educational levels inside a group in accordance with categories of users. The designation "E→U" in this column refers to an opportunity for grouping of resources in accordance with categories of users inside a group for educational levels. The designation "U↔E" in this column refers to an opportunity for grouping of resources on educational levels inside a group in accordance with categories of users and vice versa.

The sixth column "Types of information service" indicates which information service is provided for the users in the system. For designation of types of information service, the following abbreviations are used:

a—Access to databases;

b—Search for contact information;

c—Access to educational programmes and information on institutes;

d—Organisation of co-operation.

The seventh column "Volume of information" indicates the volume of this system. The quantity of references to information resources in the structured catalogues is indicated, the quantity of resources in information databases is indicated and the main databases of systems are listed.

The eighth column "Search system, availability and functionality" indicates the availability of search mechanisms on the servers of the systems and in the databases of the systems. The systems can include a few search mechanisms (in accordance with the server of the system and the databases of the system). The abbreviations are used for the description of the functionality of the language of enquiry of the search mechanisms. If the language of enquiry allows indication of the importance of a certain attribute, then this column shall include a respective letter designating:

U—Category of user;

G—Geographical scope;

- T—Topic, sub-topic, ...;
- I—Type of presented information (on-line courses, programmes, educational, scientific and research and methodological materials);
- L—Language,
- E—Educational level;
- F—Expression of search (phrase, term);
- B—Logical connectives in the expression of the search;
- M—Maximum quantity of the documents;
- S—Area of search (database, found,);
- A—Author;
- R—The form of a result (detailed, brief, sort, ...);
- H—Age of references;
- O—Operational system;
- C—Type of licence (freeware, ...).

The ninth column "Co-operation with other IS" indicates the availability of co-operation with other specialised systems. For indication of the type of co-operation, the following abbreviations are used:

- a—References to other systems;
- b—Joint information service;
- c—Joint projects.

Table 17 consists of two parts. The first part (Table 17.1) includes the systems, which do not provide an opportunity for searching for information. The second part (Table 17.2) includes the systems providing such an opportunity. The systems are sorted alphabetically in both tables. The number of the system corresponds to the number of the system in Table 16.

After the analysis of the systems listed in the tables 17.1 and 17.2, the volume of resources on each of the three categories of users was determined for each of these systems. In accordance with the criterion of the greatest volume of resources for all categories of users, the five systems indicated in the Table 18 were singled out from these systems with significantly high level results.

Table 18

Largest ISE

Name	Codes of educational levels presented in sections and sub-sections	Intersection of sub-headers
Education Supersite	1, 2, 3, 4, 5	—
Education-World	0, 1, 2, 3, 4, 5	Educational levels (E)↔Categories of users (U)
ERIC	1,2,3,4,5,6	Educational levels (E)→Categories of users (U)
Globewide Network Academy	1, 2, 3, 4, 5	—
The NODE Learning Technologies Network	1, 2, 3, 4, 5, 6	Categories of users (U)→Educational levels (E)

The statistical processing of the data indicated in the Table 17 allows the making of a number of important conclusions on opportunities for satisfaction regarding the information requirements of the users with the help of ISE. So, in accordance with the quantity of systems containing

resources for each category of users, it is possible to conclude that an opportunity for satisfaction of these needs by specialised ISE without consideration of the labour inputs of the search of resources. Fig. 9 presents the results of such analysis.

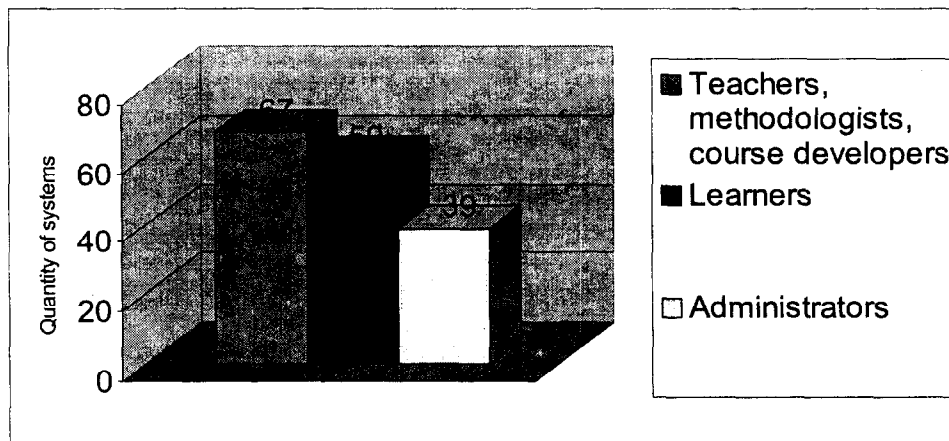


Fig. 9. Orientation of ISE toward the requirements of the various users

From Fig. 9 one may conclude that without taking into consideration the costs of the search of resources, the administrative officers are supplied with the least information resources in the specialised systems. The teachers, methodologists and developers of courses are provided with the maximum resources. The largest group of users—"learners"—is provided with the resources to a smaller degree when compared to the teachers, methodologists and developers of courses.

In accordance with the quantity of the systems providing an opportunity for the grouping of the resources in compliance with the categories of users, one may see that an opportunity exists for target-oriented satisfaction by specialised ISE of the needs with small labour input in the search. Fig. 10 presents such opportunities.

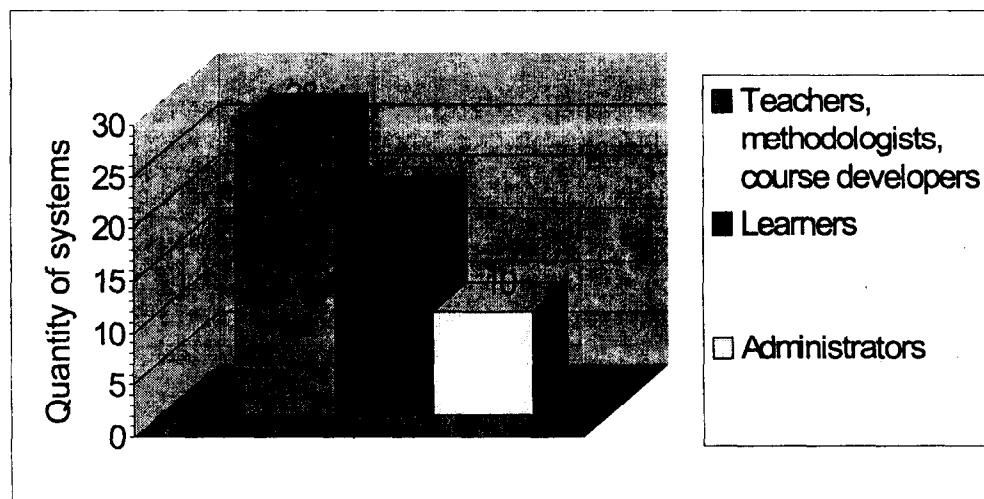


Fig. 10. Opportunities of target-oriented satisfaction of information requirements of various categories of users with the help of ISE

From Fig. 10 one may see that taking the costs of the search of resources into consideration, the administrative officers are, to the least extent, supplied with information resources in the specialised systems. The teachers, methodologists and developers of courses are, to the greatest extent, supplied with resources. The largest group of the users—"learners"—is supplied with resources, to a lesser degree, as compared to the teachers, methodologists and the developers of courses.

In terms of the quantity of ISE providing an opportunity for the grouping of the resources in accordance with educational levels, the following may be identified. To what degree the specialised ISE satisfies the needs of users for easily accessible resources of a certain educational level. The availability of resources is determined by the labour input of the search. Fig. 11 presents the quantity of systems providing an opportunity for grouping resources in accordance with a respective educational level.

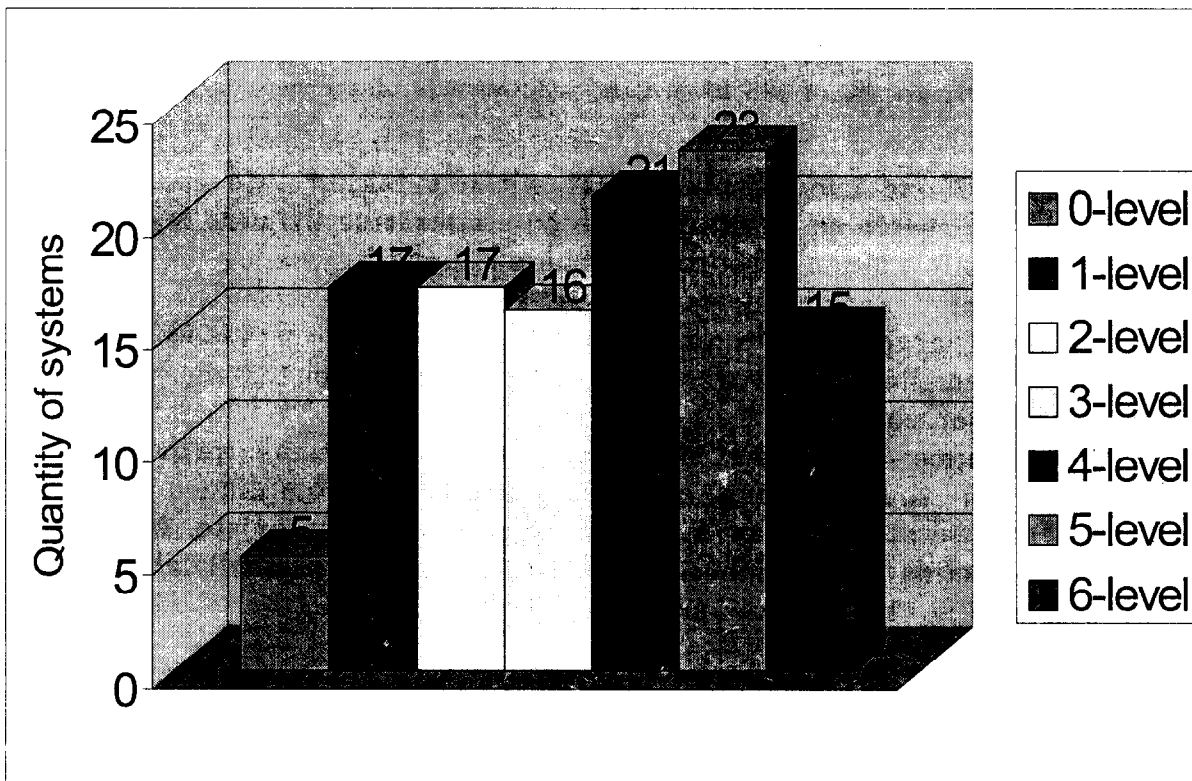


Fig. 11. Opportunity for obtaining of information in ISE

From Fig. 11 one may see that taking the costs of the search of resources into consideration the zero educational level is to the least extent supplied with information resources in the specialised systems. The 4th and 5th educational levels are to the greatest extent supplied with resources. The 1st, 2nd, 3rd and 6th educational levels are supplied with resources quite well, but much worse than the 4th and 5th levels.

In terms of the quantity of the systems providing certain types of information service, it is possible to identify the opportunities for satisfaction by ISE of the needs for types of information service. Fig. 12 shows the ISE of the types of information service.

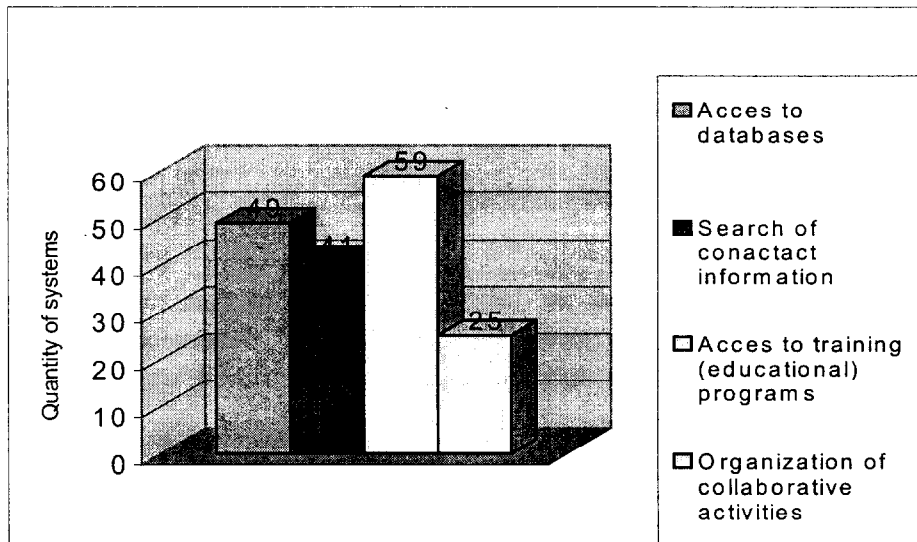


Fig. 12. Providing various information services to ISE

From Fig. 12 one may see that the specialised systems are the best in satisfying the users' needs for access to educational programmes, information on institutes and access to databases. The need for the search of contact information is satisfied to a lesser extent. The users' needs for the organisation of co-operation (only 25 systems out of 70) are poorly satisfied.

In terms of the quantity of systems ensuring a specific type of co-operation with other ISE, it is possible to identify the character of ISE interaction, degree of their integration that affects the satisfaction of all types of users. Fig. 13 shows the use of various types of co-operation by specialised ISE.

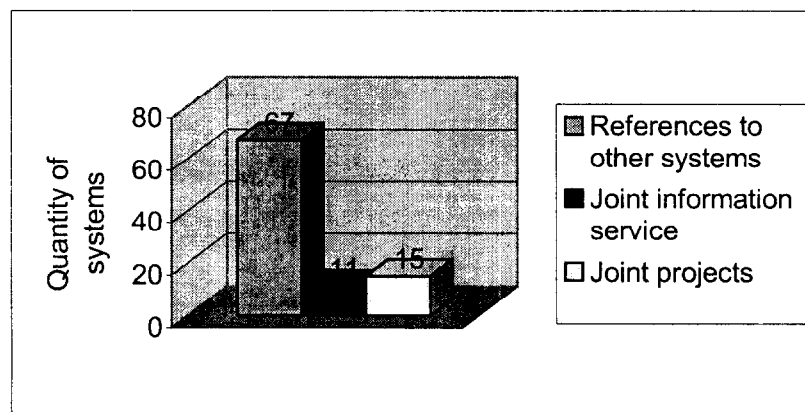


Fig. 13. ISE Co-operation

From Fig. 13 one may see that usually the specialised systems contain references to other systems in their pages. In rare cases the systems include information on joint projects (15 systems out of 70).

The joint information service is organised in the systems in fewer cases (11 systems out of 70).

In accordance with the results of the analysis of the systems for the largest ISE (see Table 18) the following has been determined:

- the quantity of educational levels for which the system provides an opportunity for grouping of resources (only seven educational levels);
- the quantity of categories of users for which the system presents information (only three categories of users);
- the quantity of categories of users for which the system provides an opportunity for the grouping of resources (only three categories of users);
- the quantity of types of co-operation with other systems (only three types of co-operation);
- the level of resources grouping (the system of the first level: grouping in accordance with educational levels inside categories of users or vice versa; the systems of the second level: grouping is possible in both directions).

By pooling all such data together it is possible to obtain a complex quantitative characteristic of the largest ISE, presented at Fig. 14.

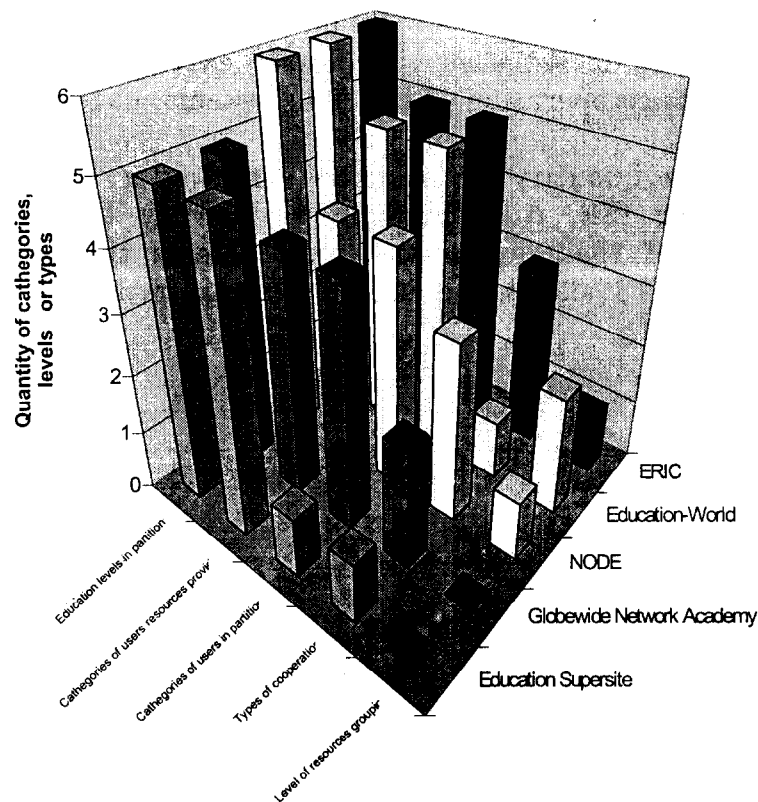


Fig. 14. The complex characteristic of the largest ISE

From Figure 14, data on the structure, the structure and volume of the resources (in accordance with the data of the Table 17) one may see that the ERIC system is one of the foremost specialised information systems on education via the Internet. At the same time, the collected data and their

analysis show that none of ISE may resolve all problems connected with education on the Internet.

Conclusions

The results of the analysis allow us to conclude that the support for the administrative officers by the information resources in the field of education in accordance with the criterion of volume of resources and the criterion of availability of easy-to-access resources is insufficient. An additional result is that the zero educational level is supplied with information resources in the specialised systems to a much smaller extent. The users' needs for the organisation of co-operation are satisfied to a smaller extent in comparison with other kinds of information service.

The generalised conclusion is that the necessity for the development of a specialised system with optimum compliance of the data structure with the contents (information resources in the field of education) having an increased share of the resources for the administrative officers of the 1st, 2nd, 3rd and 6th educational levels. Additionally, within the framework of the system development, joint projects with the developers of the best systems should be realised; a joint information service should be organised.

Taking the considerable volume of accumulated resources on education in the analysed systems (database of technologies, courses, programmes etc.) into account, there exists a necessity for the development of a system ensuring the complete integration of existing systems.

The integration of the existing systems is possible first of all through obtaining aggregated and statistical data from information systems. In accordance with the results of the analytical survey the directions on whose basis the integration of the systems is most effective may be determined. The provision of information from the existing systems within the structure determined by this analytical survey is obviously required so as to simplify the user interaction with the whole volume of educational resources on the Internet network.

It is obvious that the whole range of information required by the users cannot be completely presented by existing systems.

The creation of a system integrating all the above mentioned specialised information systems on education on the Internet is possible providing that respective agreements with the developers of such systems are agreed in providing integration, differentiation of accumulated files of data, notification of changes in the structures and filling of databases etc. An obligatory condition of the functionality of such a system will be the availability of a working group to maintain the system during its whole life cycle.

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