

Open and Distance Learning: Tools of Information and Communication Technologies for Effective Learning

Chris Panagiotakopoulos, Antonis Lionarakis, Michalis Xenos

Abstract:

This paper discusses issues related to the use of tools of information and communication technologies into the field of open and distance learning. It offers an overview of the evolution of distance education and discusses the effects of information and communication technologies into the learning environments, procedures and the teaching material. It presents examples of learning resources in the World Wide Web and emphasizes the use of the Internet as a communication means. Finally it focuses on the Hellenic Open University case and presents the use of similar technologies in this university that offers open and distance education.

Index terms: Information and Communication Technologies, Open and Distance Learning

I. INTRODUCTION

Distance Education is basically a learning / teaching methodology, an educational conception, very closed and related to special learning material and has a differentiated role for the new teacher vs. the traditional one. Garrison and Shale [5], by trying to give a definition of what distance learning is, they declared that in its educational procedure, technology has a vital role, which intermediates in order to create a two-way communication between teachers and learners for the learning process of the second.

Similarly, the U.S. Congress Office of Technology Assessment [22] defined distance education as an interactive communication between teachers and learners, who are found in different geographic places, via the technology. From the previous definitions we have a concrete relation between technology and distance education and, as it results from all the researchers, the contribution of technology in distance education it is not disputed [7].

In this study we will refer to ways in which new technologies can assist and support distance education, strengthen the role of teaching, strengthen communication and, consequently, the learning process.

II. TRYING TO BRIDGE THE GAP

From 1874, when the University of the State of Illinois was founded by offering correspondence studies, up today, information and communication technologies have influenced in a great way the offering of education by the distance teaching institutions (DTI).

We should mark, that these technologies were not created from the early beginning as educational tools. They were introduced in DTIs and soon adopted by them, since it was obvious that they improved their education procedure. What do we mean when speaking for new technologies in the course of time? It is certain that from 1874 up today this term has systematically changed, by expressing each time any form of information and communication technology. Obviously radio was an innovative object of transmission of information in the 1930s.

Initially radio was adopted from British and French DTIs. Later, telephone, television, and video were a substitute partially for the lack of communication between teachers – learners and for their interaction, by improving thus –as long as it was possible – the different conditions of distance education.

During the last decades computers and the Internet, substituted to a large extent the older means of communication. Substantially, these technologies tried (as those of today) to reduce the gap, which constitutes the “black point” of distance education (and particularly the open and distance education): the lack of contact and, consequently, the lack of a high degree of interaction between those involved in the educational process.

III. THE EFFECT OF INTERNET AND THE EVOLUTION OF DISTANCE EDUCATION

A. Evolution of distance education

With the rapid invasion of computers and networks in the daily human activities once again new technologies tried, adopted from the DTI, to serve education. Thus, in the middle of 2000 the British Open University granted the first postgraduate diplomas of specialization to its students from the entire world who attended courses via Internet.

Also, in the twilight of 20th century hundreds of conventional universities all over the world have directed a part of their operations in benefit of distance education with the use of new technologies. For example:

- In USA the Universities of Illinois, Phoenix, New York, Stanford and California (UCLA) began to function with virtual classes using the Internet.
- In Great Britain, through the operation of Internet University, traditional academic colossuses began collaborations for an exclusively on-line courses delivery. Other colleges have moved already towards this direction independently or through the union "Collegenet".
- Inter-university agreements among Mega Universities like Oxford, Stanford, Princeton and Yale attributed a new virtual university, named as University Alliance for Lifelong Learning – UALL, aiming at the offering of continuing education via the Internet. Essential equipment of their students is: a multimedia PC, software of Internet exploration, software of electronic mail and a video camera.

Is however so much easy for an institution that offers traditional education to alter as an institution of distance education? No, according to Clay [2]. There are essential reasons that often deter such a transformation or partial change. Among these, there are:

- The different role of the teacher / tutor,
- The Lack of technical and administrative support,
- Decreased quality of studies,
- Increased pressure of work and
- Negative attitudes of the staff within the institution.

As it appears, important effect in the configuration and in the evolution of distance education was the release and free access of the Internet (April 1995). Up to then communication, the educational material and the support of distance learning process were limited, respectively, in:

- (a) Postal correspondence – telephone – fax,
- (b) Printed educational material – radio transmissions – television transmissions – audio cassettes,

videocassettes – software (supported learning with PCs) – interactive video.

After 1995, with the rapid distribution and use of Internet and the network conjunction of the planet, there were created moreover possibilities for:

- Access to information and leaning sources that are found in the World Wide Web (World Wide Web – WWW resources),
- Communication and distance teaching, with the use of networks and PCs

It should be mentioned here that roughly the 70% of certified colleges with four years of study and graded schools in the USA offer to their students, apart from the traditional teaching, courses via Internet [16].

B. Virtual Universities

Internet allowed something more from all the other forms of technology: the creation of completely virtual institutions, which with minimal personnel (and cost of operation, cost of studies) can offer high standards of education. Thus, in 1999 arose through the Internet the Jones International University (JIU), the first completely virtual university, with the right approval from the academic authorities of USA.

As it appears, the 1874 studies by correspondence were converted to studies of 2002 with electronic correspondence / communication, transmission of pictures and the traditional classes to virtual classes.

The operation of the virtual classes [17] and the management of educational process exclusively via new technologies present obvious advantages, as independence in time, independence in space, flexibility, simplicity and stability in the utilization of interface of communication and guidance.

However, this presents important disadvantages, as: difficulties from the non catholic spread of the Internet and problems from the use of new technologies in distance education, as isolation of the student, lack of safety and copy rights, lack of standards according to the quality [11] etc.

IV. EDUCATIONAL TECHNOLOGY AND EDUCATIONAL MATERIAL

A. Technology and material

The used technology that is found today in the DTIs in order to support the educational process varies, and it is

difficult to be categorized. However, most DTIs [6] use the following ways to strength the offering of education to their students:

- Face-to-face meetings / tutorials between tutors and students; technology can help, at least, with the multimedia software and the presentation software. The data projector suppresses the overhead projector and does the presentation more attractive with sound and picture.
- The World Wide Web constitutes space of report of various information. Its use study programs, the reminder of obligations of the students and certain important dates constitute usual phenomenon for most DTIs.
- The World Wide Web, apart from space of information, can be useful also as space of assistance of the study programs. This tactic is usual also in the traditional educational institutions. Thus, students via the World Wide Web, from the library or their personal computer can have access to the educational – teaching material that refers to all the study program or part of these.
- Offering of distance education via the Internet. The communication for the educational process can be synchronous, asynchronous or even both.

Usually the teaching material of the study programs via World Wide Web includes:

- (a) The teacher's introduction with multimedia elements, which can be with text or with compressed video.
- (b) Special software relative to the material, which is received via the network or the student can "download" it and work with his personal computer.
- (c) Other educational materials, which the student can "download" in his personal computer, such as: files of text with questions, files of sound and pictures, files of video.
- (d) Exercises / activities for practice, written tests (even for being-line completion and automatic correction).
- (e) Connections with information resources, such as: libraries, published articles in the World Wide Web and scientific journals.

The totally virtual institutions of distance education follow the previous provision of educational material, which is followed from the timetable of study and with reminder of important dates.

B. The educational software and the learning environments

As it appears from the precedents, the educational material of DTIs is polymorphic and multifunctional. Some forms of this material, which is activated with computer, aims at the creation of *learning environments* [21]. Usually the

software of this type, functions in order to help the rest of the material and it aims at the comprehension of difficult points of the material or at the analysis of those points where the majority of students makes errors.

The learning environments are manufactured under the effect and the principles of various *theories of learning*. In the decade 1990-2000 there were studies and research with important results. The majority of applications *Computer Based Learning (CBL)* are supported by the *theories of construction of learning (constructivism)*. These theories support learning via activities which involve actively the user / learner and assist him so that he will structure (create) and discover his knowledge [13, 18].

V. LEARNING RESOURCES AND THE WORLD WIDE WEB

The World Wide Web constitutes an inexhaustible space of information. According to Relan and Gillani [19], Santi [20] and Crossman [3], the basic characteristics of learning environments that can be created in the World Wide Web are:

- The limits of learning are extensive and not limitable from space. The learner can use the environment of learning in the classroom, in his house, in places of entertainment and in his work. Thus, one of the ideal of Open Education that points out that the student has the right to determine the place of his study [10] finds ground for absolute application.
- The surfing in the World Wide Web takes place in a non serial way. The access to the source of information each time with the use of *hyperlinks* can be direct.
- Information can be approached with many different ways with the use of multimedia, by promoting active attendance and learning.
- Social interactions and cooperative methods of learning are supported with *synchronous* and *asynchronous ways of communication*.
- The operation of learning environments is reliable and their cost small if it is compared to the one in learning environment supported by computers (Computer Based Learning – CBL), or to the one which uses radio programs, television transmission or a videofilm¹.

The World Wide Web, with the exploitation of its characteristics and its resources, constitutes for the visitor a learning environment, full of information which is transmitted by multiple means. In this environment, the learning process can be promoted, supported and cultivated [8].

¹The videofilm can constitute an appreciable learning source, but as serial material means of transmission of information it doesn't enclose the possibility of interaction and it cannot promote learning considerably.

For the growth of courses and teaching material that can be exposed in the World Wide Web various tools are used, such as *Microsoft FrontPage*, *Netscape Composer* or *Macromedia DreamWeaver*. More specialized are the *eWeb*, the *Serf Distance Education Environment*, the *CyberProf*, and the *CourseWriter*.

Certain tools are even more powerful, by giving to its user greater possibilities, not only of creation of teaching material, but also of management of virtual class, communication with text, sound and video, bulletin board, facilitation of educational process etc. Common tools-platforms are: *Blackboard*, *WebCT*, *e-Education*, *Complete On-Line Teaching System*, *Virtual-U*, *Creator*, *Collegis*. In such platform of software, which the students can approach via the World Wide Web, the main learning activities that can be developed are:

- statements from the teacher / tutor in special “tables of statements” (bulletin-boards),
- statements from the students / learners,
- suspension of texts with teaching material from the teacher / tutor,
- downloading of educational material from the students,
- implementation of small multimedia applications,
- mission of mass e-mails in the members of the group,
- synchronous communication among the members with text, sound or even video,
- approach in special information (exercises, work, degrees, important dates etc).

Certain platforms of education and communication via the World Wide Web include meeting space with written text (*chat-room*) and allow the use of *whiteboard*. The whiteboard it is a designing tool that can be used in on-line discussions. It allows the typing of text, the import of objects and graphics. The teacher can also picture ready “pages”, which are received in real time from all the members of the group connected to the platform of communication of DTI and are allowed. Through the chat-room discussions are carried out with written text (also in real time) and questions are asked to the teacher, who has the possibility to answer with the time line that the questions roll up (first-in, first-out).

The evolved platforms of communication and education allow:

- (a) the transmission of information (that is to say “pages”, with forms, text and graphics) that that the teacher wants to give to his students and
- (b) the simultaneous transmission of picture and sound of the teacher in a “window” of the PC screen (*WebCast*).

So, the user has the possibility, through suitable connections (links) of the learning environment to visit, virtual libraries, articles and bibliography that is exposed in

the World Wide Web by educational institutions but also on-line scientific magazines.

However, it is not enough for somebody to place a multimedia application in a server of the World Wide Web (web server) and become acceptable as he created *infrastructure of teaching environment for open and distance education*. Certainly, for *Open DTIs*, the information and the learning environments which will be created in the World Wide Web should follow and accept principles and elements of the *methodology of distance Education and the Education of Adults*.

VI. COMMUNICATION VIA INTERNET

It should it is stressed that the role of teaching in the DTIs is complex and more exigent than that of traditional institutions. The communication between teacher and student, but also among the learners, is a fundamental component of the educational action.

Internet constitutes a powerful mean of support and communication but also the teaching process in the DTIs and in some certain forms (e.g. e-mail) with exceptionally small cost. It can offer new possibilities, changing the teacher-oriented type of education into the student-oriented [15].

A. Synchronous and asynchronous communication

Having as parameters the space and time in which there are found the teachers and the learners, communication, as it appears in *Table 1*, can be separated [12].

Table 1. Types of communication

	<i>Same place</i>	<i>Different place</i>
<i>Same time</i>	Traditional	Synchronous
<i>Different time</i>	–	Asynchronous

Communication between teacher and learner in the same time and same place, refers to the traditional classroom.

When teachers and learners communicate by being at the same time in different places, then communication is called *synchronous*, while it is *asynchronous* when communication takes place in different time and in different place. These two last forms of communication, which are run via the Internet, support today the *virtual classes of DTIs*.

If we tried to realize the basic elements of the two ways of communication between teacher and learner, we would observe the following [1, 4] as shown in *Table 2*.

Table 2. Elements of the two ways of communication

<i>Parameters</i>	<i>Synchronous</i>	<i>Asynchronous</i>
<i>Motivation on behalf of the team</i>	to a large extent	in small degree
<i>Possibility of interaction</i>	yes	no
<i>Feedback</i>	direct	indirect
<i>Student support</i>	direct	indirect
<i>Isolation of the student</i>	small	big
<i>Flexibility in space and time</i>	no	yes
<i>Breadth of technological infrastructure of DTI</i>	big	small
<i>Cost for student and DTI</i>	big	small
<i>Time for thought and control by the student</i>	minimal	big
<i>Motivation for 'contact' with the teaching material as it is forecasted by the study timetable</i>	to a large extent	in small degree

B. Types of synchronous communication

Among the modern methods of communication we find:

- the telephone communication,
- the sound-conference via connected computers (audio teleconferencing),
- the video-conference via connected computers (video teleconferencing),
- the conference with the use of “whiteboard”,
- the use of applications of chat-room type (supported in text).

C. Types of asynchronous communication

Among the asynchronous methods of communication we find:

- the use of fax,
- the use of computer software (educational Cd-rom),
- the use of videofilms,
- the use of audio tapes,
- the use of compressed video,
- the courses supported by the World Wide Web,
- the bulletin boards in the World Wide Web,
- the electronic post (e-mail).

From the above methods of communication the *videoconference* is very interesting [9]. With it, two or more parts, including technology, can be connected with sound and vision in real time. The transport of sound and picture is achieved with the transmission – reception of signal of

compressed video-sound (streaming video-audio), with the help of suitable software.

Insofar, for synchronous and asynchronous communication can be used:

- radio transmission,
- cable television,
- satellite transmission of vision.

From the used technologies via the Internet, the electronic mail and the applications that provide discussion (chat-rooms) we have worldwide the most common means of support of the learning process in distance education. The previous means, with the tables and videoconferences, encourage the *distance cooperation*.

VII. THE VIDEOCONFERENCE

The videoconference, which gives the possibility for face-to-face communication and guidance, constitutes a useful educational tool. Many DTIs have adopted it, as means of facilitation of communication and educational activity between teacher and learner. However, it cannot support exclusively the educational process in a DTI [14]. The important advantage that is offered with its use is the wide scale of interaction that can take place among the participants. It can be separated in *videoconference of main room* and *videoconference of point to point – videoconference of multiple points*.

VIII. THE HELLENIC OPEN UNIVERSITY

In Greece things are somehow different concerning the possibilities which can be found in new technologies and their adoption by various DTIs worldwide. The illiteracy among adults of the use of PCs and the provided services from the Internet with still low speeds of flow of data concerning the relatively high functional cost of connection cannot currently render the modern technological means cores of exclusive support of educational activity from a local DTI.

As it results from the proceeding of the Governing Board meetings, the Hellenic Open University (HOU) with careful steps tries to adopt progressively the use of new technologies to the benefit of the administrative and educational process. As most Institutions of Higher Education it has the resources. But do the students have?

The complete incorporation and adoption of new technologies today globally (for all that is to say the programs of study) by the HOU will constitute rather cause of breach of one ideal that it invokes: *the access of equal opportunities of education to all Greek citizens*. The printed

educational material should remain the heart of educational material of the students for most study programs, until the overwhelming majority of citizens have the possibility of access to the Internet, and in particular with speeds of flow of data that allow completely his exploitation as educational tool.

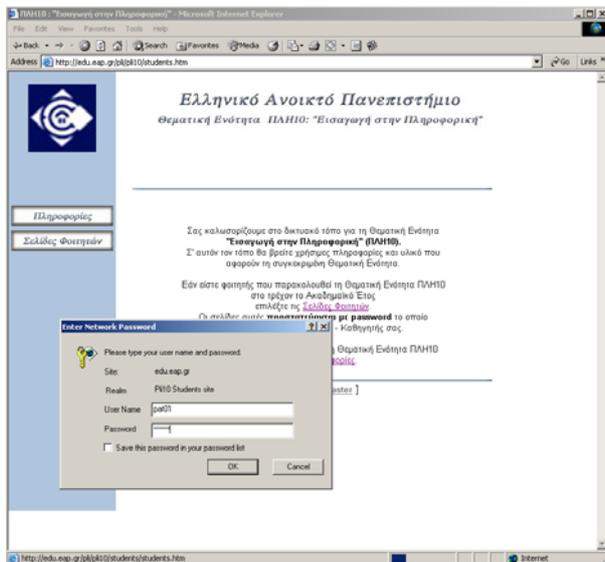


Figure 1: Entry point of INF10

This does not mean, of course, that the production of alternative material and research will continue to the direction of complete incorporation of new technologies in the institution.

Already, in study programs where the students profile allows more rapid adaptation in new technologies, important changes have begun with regard to the infiltration of new technologies. For example in the Informatics Course the e-mail had already been established as the basic means of student-tutor communication for almost 100% of the students (including the newly registered ones). Furthermore, assignments were delivered only electronically. The central web site now offered only generic information, while specific web sites (portal-like) were provided for each module. Figure 1 shows the entry point of the module INF10 student site.

Although the students' response to the above changes was enthusiastic, a few educational problems occurred. Making a variety of additional material available to students created the need for providing further guidance to each student about selecting the material that suits his/her particular needs best. This caused a slight change in the tutor's role who now undertook a more consulting role, having to aid

the students in managing their time and selecting the appropriate material.

The tutors' forum proved to be valuable in coordinating this consulting effort, while students' fora were developed for specific module groups. Although the majority of students were in favor of using a forum (approximately 75%), the students' fora were not all successful. The success of a forum proved to be strongly related to group specificities and the tutor-student preferred communication style. In many cases the use of e-mail and the provision of a group-specific web site including an announcement board was more effective than the forum.

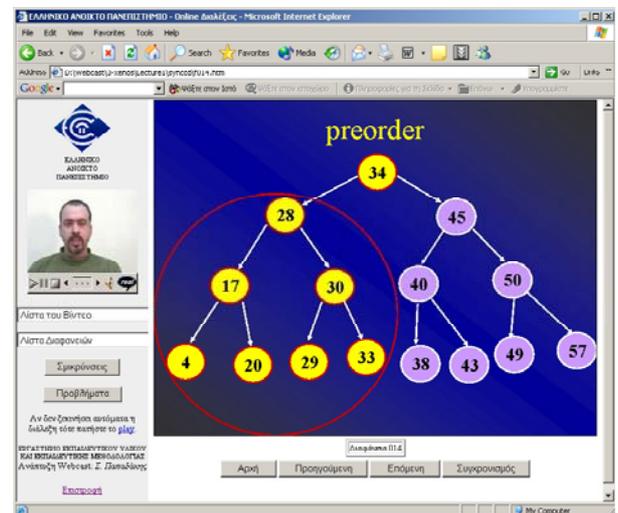


Figure 2. A typical Webcast.

During the current academic year 2002-2003, each tutor-students group in the Informatics Course uses either a forum, or a group specific web site and e-mail for communicating, depending on the specific group needs and the module. During this year an important step was taken towards the adoption of new technologies by setting up student groups such as the A14 group in INF10. This group comprises 32 students, geographically distributed among the Aegean Islands. The first meeting of this group was held in Athens, while all the rest were held in a virtual classroom². In the latter case the students had the opportunity to join the virtual classroom and attend the meeting from their island. All meetings were recorded and made available through the group's web site so that the students can review them later, or be briefed on what was discussed in case they had not joined the meeting.

Furthermore, Webcasts, such as the one shown in Figure 2 (also called video lectures) were developed and offered

² Based on CentraOne 6.0 ©

through portals, while HOU will store the entire material required for a course module and then mail it to students with no extra cost, since such mailing can be bundled with the scheduled mailing of printed material.

From all these we conclude that the Hellenic Open University:

- (a) is directed to a complete incorporation of new technologies when the conditions will allow it,
- (b) contributes to the demystification and to the acceptance of use of new technologies from wider layers of Greek society.

IX. CONCLUSION

The model of the industrial season, of traditional education with the black board and the chalk appears to belong to the past. Distance education appears strengthened with the use of new technologies, where can be found and coexist with traditional education.

In distance education the facilitation of the virtual students from the new technologies is obvious. They can work, stay at home and study without any social, family or other problem. The advantages are many, but also the compensation rather important: they are deprived the experience of student life, the freedom that this exudes, as well as social connection. Particularly in distance education the use of Internet, with peak the videoconference, can decrease the lack of contact between teacher and student and strengthen the educational process. As it appeared from the precedents, the new technologies do not constitute simply an alternative solution, particularly for distance education.

REFERENCES

- [1] Aoki, K. & Pogroszewski, D. (1998). Virtual University Reference Model: A Guide to Delivering Education and Support Services to the Distance Learner. *On line Journal of Distance Learning Administration*, 1, 3.
- [2] Clay, M. (1999). Development of Training and Support Programs for Distance Education Instructors. *On line Journal of Distance Learning Administration*, 2, 3.
- [3] Crossman, D. M. (1997). *The Evolution of the World Wide Web as an emerging instructional technology tool*. In Khan, B. H. (ed.), *Web-based Instruction*. Englewood Cliffs, N.J.: Educational Technology Publications.
- [4] Ellis, B. (1997). *Virtual Classroom Technologies for Distance Education: The Case for On-line Synchronous Delivery*. Available: <http://www.dctac.com/solution/naweb97.htm>.
- [5] Garrison, D. & Shale, D. (1987). Mapping the boundaries of distance education: Problems in defining the field. *The American Journal of Distance Education*, 1, 4-13.
- [6] Gerson, S. M. (2000). E-CLASS: Creating a Guide to Online Course Development for Distance Learning Faculty. *On line Journal of Distance Learning Administration*, 3, 4.
- [7] Jones, A., Kirkup G. & Kirkwood, A. (1992). *Personal Computers for Distance Education – The Study of an Educational Innovation*. London: Paul Chapman Publishing Ltd.
- [8] Khan, B. H. (1997). *Web-based Instruction* (ed.). Englewood Cliffs, N.J.: Educational Technology Publications.
- [9] Kies, J., Williges, R. & Rosson, M. B., (1997). Evaluating Desktop Video Conferencing for Distance Learning. *Computers & Education*, 28, 2, 79-91.
- [10] McCormack, C. & Jones, D. (1998). *Building a Web-Based Education System*. New York: Wiley.
- [11] Miller, M. D. & Padgett, T. C. (1998). Redesigning the Learning Environment for Distance Education: An Integrative Model of Technologically Supported Learning Environments. *On line Journal of Distance Learning Administration*, 1, 1.
- [12] Oliver, R., Omari, A., & Herrington J. (1998). Investigating Implementation Strategies for WWW-Based Learning Environments. *International Journal of Instructional Media*, 25, 2, 121-128.
- [13] Palloff, R. & Pratt, K. (1999). *Building Learning Communities in Cyberspace*. Jossey-Bass.
- [14] Passerini K. & Granger, M. J. (2000). A developmental model for distance learning using the Internet. *Computers & Education*, 34, 1-15.
- [15] Perrin, M. K. & Mayhew D. (2000). The Reality of Designing and Implementing an Internet-based Course. *On line Journal of Distance Learning Administration*, 3, 4.
- [16] Porter, L. (1997). *Creating the Virtual Classroom: Distance Learning with the Internet*. Wiley & Sons.
- [17] Reeves, T. C. (1993). *Evaluating interactive multimedia*. In Gayeski D.M. (ed.), *Multimedia for learning: Development, application, evaluation*. Englewood Cliffs, N.J.: Educational Technology Publications.
- [18] Relan, A. & Gillani, B. B. (1997). *Web-based information and the traditional classroom: similarities and differences*. In Khan, B. H. (ed.), *Web-based Instruction*. Englewood Cliffs, N.J.: Educational Technology Publications.
- [19] Santi, P. A. (1997). Interactive World Wide Web-based Courseware: Similarities and Differences. In Khan, B. H. (ed.), *Web-based Instruction*. Englewood Cliffs, N.J.: Educational Technology Publications.
- [20] Stenerson, J. F. (1998). Systems Analysis and Design for a Successful Distance Education Program Implementation. *On line Journal of Distance Learning Administration*, 1, 2.
- [21] U. S. Congress Office of Technology Assessment (1989). *Linking for Learning: A New Course for Education*. Washington: U.S. Government Printing Office, p. 4.
- [22] Lionarakis, A. & Lykouryiotis A. (1998). *Open and Traditional Education*. In: Vergidis, D., Lionarakis, A., Lykouryiotis, A., Makrakis, B. & Matralis, H., *Open and Distance Education, Volume 1 – Institutions and Operations*. Patras, Hellenic Open University.