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THE SPANISH UNED, A TECHNOLOGICAL UNIVERSITY

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1. INTRODUCTION

No-one can dispute that today open/distance education/ learning is an instrument of the first order for extending permanent education, taking this to mean the "organising principle of education which aims to extend it, at all levels and in all its forms, to the whole population, throughout life, with the cooperation of various sectors, institutions and agents" (García Aretio, 1989: 108). Throughout the world, including Spain there are today various public and private institutions that are developing this principle of permanent education through distance education. Education is reaching more people, at various levels (university and non-university) and forms (formal and non-formal - retraining, un-regulated professional training, refresher courses, etc.) and throughout the whole of their lives.

We define distance education as a "technological system of bi-directional communication which can be large-scale and which replaces the personal interaction of teacher and student in the classroom as the preferred teaching medium, using the systematic and combined action of various resources/teaching media and the support of an organisation and tutors that promote independent and flexible learning on the part of the students" (García Aretio, 1994: 50). However, we are going to concentrate exclusively on just one of the features or characteristics which form part of this definition: the supporting educational resources/media.

Distance education rests on three basic pillars: materials, channels of communication and teaching, although the last can be considered in some cases as a channel of communication which is either face-to-face or distance. We are going to look at the first two pillars. Both of them come into the category of resources or media which provide students with access to the sources of information (Change et al., 1983), making the relationship between teacher and student possible. And it is not difficult to deduce that the media are intimately linked to technology (Ramos, 1995).

We shall also ignore the basic resource in the vast majority of distance institutions, the printed medium which, although it is a resource which requires a specific technology for its design, production and distribution, is beyond the scope of this congress.

Well, having made the preceding considerations, we are going to look at a specific situation, a state-funded university institution which uses most of the technologies man has made available to education. We refer to the Spanish UNED (Universidad Nacional de Educación a Distancia). A state-funded university, it was created in 1972 and in the 1995/96 academic year had the largest number of students of all the Spanish universities - 152,000 - who learn exclusively by means of distance education. This university currently has 1,000 lecturers in its Headquarters in Madrid, and 3,900 tutors in its Associated Centres. It offers 16 regulated university courses and 250 unregulated open courses (non-formal education).

2. THE EVOLUTION OF THE UNED TECHNOLOGIES

Perhaps first of all it would be a good idea to sketch in briefly the great milestones in the history of communications. At the beginning of our history we human beings communicated using signals and gestures accompanied by sounds. Later we communicated through spoken language. Then we needed to communicate across distances beyond the reach of voice. Thus emerged smoke signals, flashing mirrors, flags, drums, etc. By 1830 we had began to communicate at a distance by telegraph and Morse code (1820). In 1876 the Scot, A. Graham Bell, invented the telephone, which enabled us to communicate verbally at a distance. In 1894 the young Italian G. Marconi invented the radio and 1901 saw the first trans-Atlantic communication by radio, although the first radio station in America did not start broadcasting until 1920. Teletype (1910) enabled written messages to be sent over distance using certain codes and 1923 (Vladimir Zworykin) saw the arrival of television which began its first regular broadcasts in 1935. The analogue computer dates from 1930 and the digital version from 1945 - presented in 1946 (Electronic Numeric Integrator and Calculator - ENIAC - weighing 30 tons). We won't go on, because we know that we are all well aware of the present situation of these and other resources that have appeared more recently.

In the case of the UNED, this university has evolved in the adoption of new technologies just like other distance education institutions. In practice, distance

education has passed through three main stages or generations of technological innovation which Garrison (1985 and 1989) identifies as correspondence, telecommunication and telematics. Let's pick out the main aspects of Garrison's hypothesis.

Before the UNED was established, very rudimentary texts which were not very suitable for independent study by students were used almost exclusively in what Garrison called the first generation. Then these texts began to acquire a different structure and were accompanied by study guides, workbooks or evaluation, etc. The latter part of this first stage began to see the appearance of the tutor, or student guide, who answered the student's queries by post, returned corrected work, encouraged the student not to give up his studies and even had some face-to-face contact with him.

Multimedia distance education, or in Garrison's terminology, the second generation, was introduced at the end of the sixties and beginning of the seventies (birth of the UNED). Radio and television, media present in most homes, are the hallmark of this stage. The written text - which is still essential - begins to be supported by these audiovisual resources (audio cassettes, slides, video cassettes, etc.). The telephone is included in much of the work in this sphere, to connect the tutor with the students.

The third generation would comprise telematic education. The integration of telecommunications into other educational media, through the use of computers, defines this stage. This third generation is supported by the increasingly widespread use of the personal computer and activities using Education Assisted by Computer (EAC). This integration makes it possible to move on from the traditional concept of distance education to a kind student-centred education. In this third generation of distance education, the limitations of time and space are finally eliminated; the interactive process is improved; new forms of communication in the educational setting appear which make group learning possible. Something like a ring or network of communications is established to which each participant in the educational process can communicate with the other participants, wherever he or they may be. The immediacy and flexibility, the vertical and horizontal character of the traffic of communications becomes apparent.

Having reached this stage we (Gagne, 1977; Baat, 1983; García Aretio, 1994) suggest that any high quality technological product - not communication channel - designed for training, should be carefully planned and fulfil a series of conditions that demonstrate its usefulness for distance education. Thus a particular package for distance education should be:

Suited to the level and type of course in question (field of knowledge or skill concerned).

- Aimed at the expected characteristics of the target group in general and the student in particular. It is not aimed at the teacher.

- Complete, by establishing the appropriate recommendations for leading or guiding all the student's work.
- Integrated, interlocking all the resources to form a unit in which some media provide what others cannot cover.
- Accessible and managable. Materials it is possible handle without great difficulty. On the other hand, the technology must be easy to deal with (it should not add another difficulty to the difficulty of the actual course or material).
- Standarised, in order not to create problems for students or centres.
- Flexible and open. Adapted to different contexts, rhythms, styles and capacities of learning. Not closed; it should invite criticism, reflection, and expansion on the material studied.
- Encouraging the student's self-motivation; it should effectively transmit the information; present problems and questions by questioning which obliges analysis and reflection; it should clear up doubts which could foreseeably obstruct progress in learning; it should favour significant functional and active learning, acquired autonomously.
- Encourage the ability to apply what is learnt. It should facilitate the positive transference of what is learnt, in a retroactive and proactive, vertical and horizontal way, through the presentation of parallel situations, examples, activities, exercises, etc.
- Interactive. It should maintain a stimulating and permanent dialogue with the student which invites the exchange of opinions.
- Efficient: The cost-benefit ratio should be positive in time and money. It is worth asking, are better results obtained in less time using this material, given its cost?
- It should invite self-evaluation of the training.

We are going to take a closer look at the different technological media (materials and channels of communication) which, omitting the best known - printed material - today shape the technological reality of UNED.

3. AUDIOVISUAL RESOURCES IN UNED

The UNED has a Centre for the Design and Production of Audiovisual Media (CEMAV) responsible for producing radio programmes and audio and video cassettes. This centre is one of the services that, by legal mandate, the UNED must have in order to ensure the proper provision of its type of distance education "through radio, television, magnetic tapes, videomagnetic tapes and any other analogous medium" (Decree founding the UNED).

3.1 Radio

This is a technological medium used by most of the distance universities in the world and many other non-university institutions, and is next in importance after

printed material. The advent of the radio at the beginning of the 20th century and its great capacity for reaching everyone proved it to be a medium worth being taken into account for the purposes of distance education. Its drawback lies in the real possibility of listening to the programmes when the times do not coincide with the time the working student is available to listen to them.

3.1.1. Educational possibilities of the radio

We are going to offer some of the possibilities we (Marín 1988 and García Aretio, 1994) consider justify the use of radio for training purposes in the UNED of Spain. Because of its relationship with the written material:

- It offers up-to-date information, which could not be covered in a written text.
- It looks at a topic or aspect in depth.
- Presentation of highly topical cases and examples.
- It makes known to students the voices of outstanding figures in the area of knowledge concerned, and those of the teachers, who are physically distant.
- Introduction to disciplines in order to define their scope and methodology.
- Application of theories, concepts or methods of the course content, to specific situations.
- Exposition of the subject from the critical point of view, offering other approaches and alternatives which do not appear in the text.
- Presentation of the content in a dramatic way, re-enacted, sometimes with new points of view.
- The posing of questions which encourage the expansion of information, contributing personal answers and original resolutions to cases.
- It offers new syntheses, integrative aspects, or conceptions not formulated in the text, taking recent contributions into account.

Because of its relationship with the students' tasks:

- Preparation of the evaluation tests.
- Motivating exposition of the results of evaluation tests.
- Rapid communication of news, notices, information.
- Suggestions for tasks and activities which might help students to improve on those learning tasks at which a large number fail.

3.1.2. The radio in the UNED.

Radio has been used by the UNED for over 20 years. At present the University broadcasts a daily programme, from Monday to Friday, two-and-a-half hours long, which has national coverage, broadcast by Radio Nacional de España. The audience studies periodically carried out show that these programmes are listened to, in addition to the students of this university, by a large number of listeners who thus benefit from this important cultural contribution of university level.

The most usual ways in which teaching staff of the UNED take part in radio programmes is in interviews, discussions and lectures. Interviews are carried out by a professional interviewer of the CEMAV who asks the teacher the questions which will enable him to transmit appropriate information to his students. By means of the discussion group or round table, a group of experts directed by a moderator convey to the listeners, through a dynamic and fluent communication, topical subjects related with the material or materials being studied. A lecture is given exclusively by a single teacher. Only those teachers with great capacity for communication succeed in making this third type of programme popular.

All the UNED radio programmes are recorded and sent to the Associated Centres so that students who wish to listen to them or copy them onto tape can do so. At present the CEMAV has a total of 17,000 cassettes containing the UNED radio programmes recorded each year.

3.2. The audio cassette

The popularity of the audio cassette is indisputable due to its price, durability and easy manageability, although it is well known that other more sophisticated media are trying to improve on it.

3.2.1. The advantages of the audio cassette

In our opinion in the UNED, the advantages of this medium are undoubted. We list them as follows:

- It overcomes the barriers of time and space.
- Easy to carry.
- Entirely under the user's control.
- It can cover a wide range of learning objectives and content.
- Much of the content is very easy to produce.
- Students can be tutored by sending the cassette by post and returning it with the teacher's immediate responses.
- It is a cheap and robust medium.

3.2.2. The audio cassette in the UNED

The CEMAV and the UNED produce a considerable number of audio cassettes in the course of each academic year, apart from the radio programmes broadcast (17,000 cassettes). Each year lecturers who think the use of this auditive resource may be useful for their subject apply for cassettes to be made. Today we have about 37 collections of cassettes produced in the various subjects taught. Some collections are made up of 6 or 8 cassettes.

3.3. Television and the video cassette

3.3.1. Television in the UNED

Today it would be difficult to question television's potential for education. Since 1991 the UNED has had some experience in this field, although in the form of short programmes broadcasted by the state-owned TV channels.

Thanks to the launching of the Hispasat satellite and the Canal Clásico (Classical Channel) on Spanish state TV, the UNED's educational Television programme was inaugurated

on 29 January 1996. This is broadcast for an hour each day Monday to Friday and repeated on Saturday mornings. The programmes are produced entirely in the UNED's facilities, the lecturers working in cooperation with the technical personnel concerned. All the Associated Centres have an Audiovisual Media Room with the necessary equipment for receiving and recording these programmes.

The programmes are aimed at UNED students, at all university students and anyone else interested in scientific and cultural matters. There is a programming schedule which includes information about the UNED and the university world in general, discussion programmes, round tables, laboratory practices, debates, etc. and other programmes of a cultural nature which fits in with this programming.

3.3.2. Video

The video is an electromagnetic tape on which can be recorded and reproduced, using a video recorder, information of various types: images, sound and special codes (control, synchronisation, etc.) in an analogous way (the signal recorded is similar to the original). Video tapes, like audio tapes, are seen in the UNED as a material which is integrated with written material to produce multimedia packages. Each year UNED lecturers can apply to have didactic videos produced, and after the applications have been submitted to various committees, they are approved by the Board of Governors. They are produced entirely in the UNED with the mutual cooperation of the teaching staff who design the script and the technical personnel of CEMAV.

The videos produced in the UNED answer particular aspects of the various subjects. In other cases they form part of collections which are expanded year after year. So far the UNED has published more than 180 educational videos.

4. INFORMATICS AND TELECOMMUNICATION IN THE UNED

Two technologies are involved in telematics: telecommunications (sending information over a distance) and informatics (data processing). Thus, if we take advantage of the great advance in these technologies and the no less important one in education and learning with new methodologies based on solid theories, we are in a position to make great strides forward in the world of education.

4.1. The telephone

Although it might seem odd to include the telephone in this section, we do so because it is a support medium for teaching/learning, an auditive way or channel of communication which, as we shall see later, is also used by informatic systems.

4.1.1. The conventional telephone

There are virtually no kinds of distance education which do not use the telephone for communication between the student and the teachers. The telephone is a very effective medium in a distance institution because it allows a direct and interpersonal relationship with the same immediacy as in the classroom, but without the presence of the fellow students, which can sometimes be coercive. The possibility of reducing the feeling of solitude, answering questions, receiving guidance, connecting orally with the teacher, avoiding having to travel to the - in many cases - remote centre for attention or support, etc. are undoubted advantages of this medium.

In the UNED's Headquarters all the teaching staff are obliged to spend four hours a week doing afternoon telephone "duty", with the object of dealing with calls from students and tutors. The IBERCOM telephone system makes it possible to maintain a permanent automatic answering service which facilitates this system of communication. Similarly the tutors at the Associated Centres have to deal with calls from their students.

4.1.2. Advanced telephonic applications

Other advanced telephonic applications exist in the UNED which make possible, amongst other things, the communication and transfer of data between computers or the automatic telephone reply service which, by means of an ordinary telephone call and interactively using the dialling buttons of the telephone, make it possible to obtain the information required which is stored on a computer in voice form (Caprio, 1995).

The UNED has a telephonic answering service called S.I.R.A. This service is used by the students to obtain certain information such as, for example, the entrance examination grades or those of the various subjects in the degrees taught in the

University; the acceptance of an application for a place or the situation of the matriculation completed. This service operates without interruption 24 hours a day.

4.2. Videotex

The Spanish IBERPAC network makes it possible to gain access to the videotex application provided by a large number of data bases which are in various computers called servers. Using a videotex terminal or a computer equipped with a modem, the user connects to the videotex through the normal telephone network.

The major drawback of this system is that the low speed of transmission translates into high costs because of the time necessary to obtain certain information. For this reason the future of this telematic service does not look very hopeful.

The UNED has had a Videotex Server Centre since 1990. By means of this service the students have access to certain information of interest concerning academic aspects and general information about the University. There is a public access service with general information about the university, entrance examination grades, applications, information on scholarships, courses, assistance and offers of employment.

For each Faculty and School there is a limited access server, reserved for students who have been previously given permission to use it. The students can thus access specific information in those subjects in which they are matriculated, marks for face-to-face tests, communication with the teacher using X400 electronic mail, etc.

4.3. Videoconferencing

Videoconferencing makes it possible, through the telephone network, to integrate voice and moving images in real time. Using videoconferencing it is possible to see and hear what is happening at the other end of the line while at the same time being seen and heard by the people at that end of the line.

Telefónica's Integrated Services Digital Network (ISDN) enables users to access, integrate and use all kinds of information in the form of voice, data, image and video, guaranteeing digital continuity from one end to the other. In summer 1993 Telefónica began to operate this network on a commercial basis.

The videoconferencing systems can be integrated into a computer equipped with the appropriate card and video camera and, what is now becoming more common, domestic videoconferencing equipment.

Once Telefónica had started operating the network, the UNED began its experience in this field in October 1993. At present this network in the UNED is

called Educational Videoconferencing Network (REVC) and comprises 39 sets of equipment, four installed in the Headquarters and the others in Associated Centres. This expansion makes the UNED's REVC the biggest videoconferencing network in Europe in the education sector.

Through this network working meetings have been held between teachers at the Headquarters and those in the Associated Centres, and also presentations and discussions and, even, very occasionally, the odd "face-to-face" examination. However its use on a large scale has been devoted to discussions or meetings between the teacher at Headquarters and the students of the Associated Centres and their tutor.

Most of the videoconferences held so far have been point to point, although some multi-conferences have also been held which have made it possible to connect various halls simultaneously.

4.4 Computer networks

We have already mentioned the videotex system. There are better ways of using the computer as a medium of communication for teaching purposes. One very traditional way is to establish a connection between a computer with a modem and another central one which many people can access to ask or answer questions or give an opinion. These are BBSs (Bulletin Board System). In the UNED the BBS system has been used in some postgraduate courses with good results.

In Spain Telefónica's Infovia system has just begun to expand. This network, which provides access to the Internet, is seen as low-cost solution that will meet these needs which we are discussing. The UNED is connected to the Internet through the IRIS Network. All the teaching staff at Headquarters have complete Internet access. There are increasing numbers of students who also have their own connection. In 1996/97 Infovia is initiating in the UNED -through the connection of the Headquarters with all the Associated Centres - new experiences of an administrative and educational nature. During the 1995/96 academic year the information offered in the UNED Internet pages (<http://www.uned.es>) was being completed.

4.5. Computer-assisted learning

Computer-assisted learning (CAL, CAI) is based on the neobehaviourist methodology of programmed teaching, although at present the rigidity of this type of learning has been overtaken by more flexible CAL programs.

In this form of teaching, educational materials are selected and presented on the screen, in keeping with the student's needs and rhythm of learning. The student-computer interaction is very intense. Present systems try to guide students through

the Teaching Unit in an "intelligent", less sequential -behaviourist - way as the first CAL. The computer programs produced in recent years incorporate the possibility - using an expert system - of analysing the student's knowledge to adapt him, in accordance with his level, to navigating through the computer program.

The methodology is active (full computer-student interaction), individualised (it is adapted to the student's knowledge and rate of learning) and independent (there are no set or restricted timetables)(Segovia, 1993).

Although in the UNED, through the University Institute of distance education (IUED) various invitations to tender for Computer-Assisted Learning projects have been issued, this has not proved to be a massively used resource. Only some subjects make use of it, while others simply make use of the system for setting the students self-evaluation tests.

5. MULTIMEDIA SYSTEMS IN THE UNED

Multimedia or hypermedia systems consist of an information network comprising audio, video and text and graphic data bases using computer technology and which is non-sequential in character.

These systems permit the user to initiate and develop a dialogue, answer questions, resolve problems, explore and receive answers... Its basic advantages is that of integrating three fundamental technologies in distance education: text, cinema (sound and video) and computers, (CAL for example). If these technologies have demonstrated their respective advantages to us, and their potential for interactivity, the multimedia system can multiply this potential.

The rate of learning can be controlled at all times by the student, since he decides the dynamics of the way the information is presented. The interactive potential is total in order to reinforce the process, fix the things learnt and evaluate them. It is useful both for individual learning processes and group ones.

The UNED began in the 1994/95 academic year, through IUED, to prepare a team of more than 100 technology teachers to produce multimedia material. Some subjects incorporate a CD-ROM into their material. The plan is to continue introducing them on a wider scale into the new syllabuses.

6. CONCLUSION

The more or less extensive use of the telephone, radio, cassette, television, video, videotex, videoconferencing, multimedia, Internet and Infovia, makes UNED the most important Spanish centre of permanent education (and one of the most outstanding in Europe) in the use of the new technologies, both because of their variety and because of the number of users.

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