A Multimedia Server for Remote Training: STIM.

P. Camps°, M. Jacob+, P. Bazex*, and C. Bouysset+

° Univ. P. Sabatier, 31062 TOULOUSE Cedex, FRANCE.
E-mail: camps@cix.cict.fr
* + Université P. Sabatier, 31062 TOULOUSE Cedex, FRANCE.

Abstract

In this paper, we present the evolution of Distance Education in accordance with technology, especially with the advent of multimedia. We believe that multimedia resources can have high pedagogical content. As part of a Distance Education project, we decided to formalize a Teletraining Interactive Multimedia System called S.T.I.M. We try to use multimedia to palliate the main difficulties of Remote Training: distance and teacher's absence. We give a description of our system which is tested in our University: it is based on distance self-training, video use and teacher contact. Finally, we speak about perspectives integrating Artificial Intelligence technology and digital treatment of pedagogical contents.

Introduction

Multimedia computing can be defined as the use of individual or networked personal computers or workstations to create, develop, view or use applications employing a combination of different data formats. A document containing at least two monomedia is multimedia.

While most distance education still remains primarily print based, more and more institutions are moving to the use of electronic technologies [BAT,90]. Nowadays, multimedia is investing distance education. But, in spite of the increase of computer means and communication systems, it still remains difficult to make a choice and to find a compromise between efficiency and costs.

Distance Education and Multimedia

For a long time, distance education has used paper as a course medium and postal services as a communication system: these two constitute a correspondence course. The student receives his course and periodically submits knowledge tests to a teacher who returns them corrected. This system is used for example for revisions during the summer holidays.

A step forward was made with the use of radio and television (video conference). These systems allowed the transmission of large amounts of information to a great number of students. But this technology is expensive and the level of interactivity between student and teacher is low.

In recent years, the advent of new technologies has transformed distance education systems. With the use of all present telecommunication resources (facilitated by the growth of digital networks like NUMERIS in France), it is now possible to establish and maintain an interactive relationship between the student and his teacher in spite of distance. This relationship is a vital component in training, and in the transmission of knowledge.

Moreover, there is a slow but steady growth of multimedia use in education, such as the production and utilization of data supports using either computer technology (courseware for example), audio-visual resources (video cassette), or a combination of both (videodisk driven by computer, etc...).
This approach which offers a wide range of supports, brings a new dimension to the field of personal training, an always delicate learning phase.

The student is the focus of the learning process and he manages his own training [LAG,93]. this approach is called "Open-Learning".

The sketch below explains the present evolution and our field of research with regard to distance education.

In distance education, the teacher's position is structured around the following triangle:

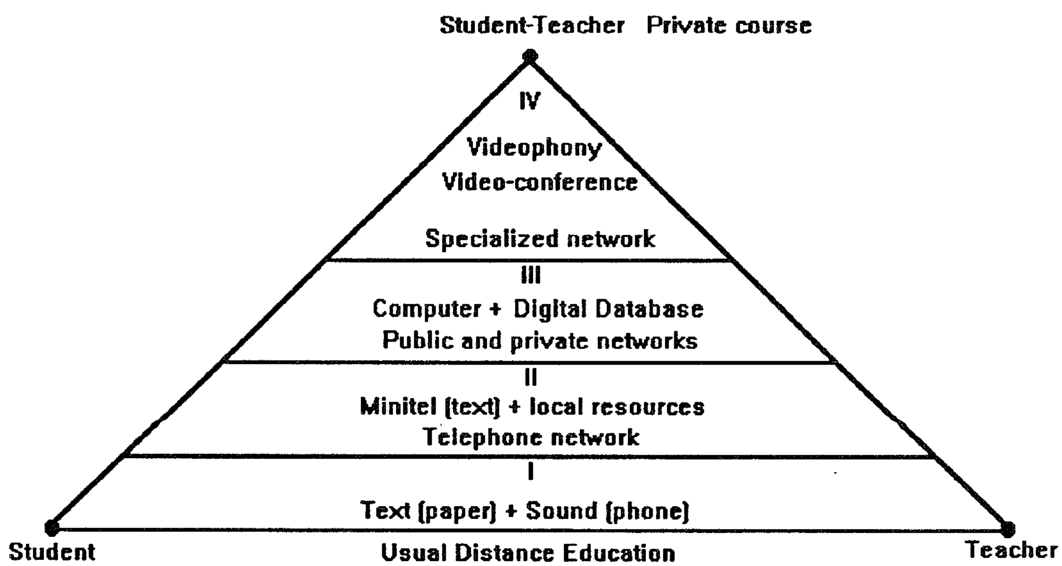
Our research scope concerns levels II and III.

At the second level, local resources consist of analogical data (pictures + sounds). The material interactivity is made by distance driving of these resources while information transmission takes place through public networks like the telephone system.

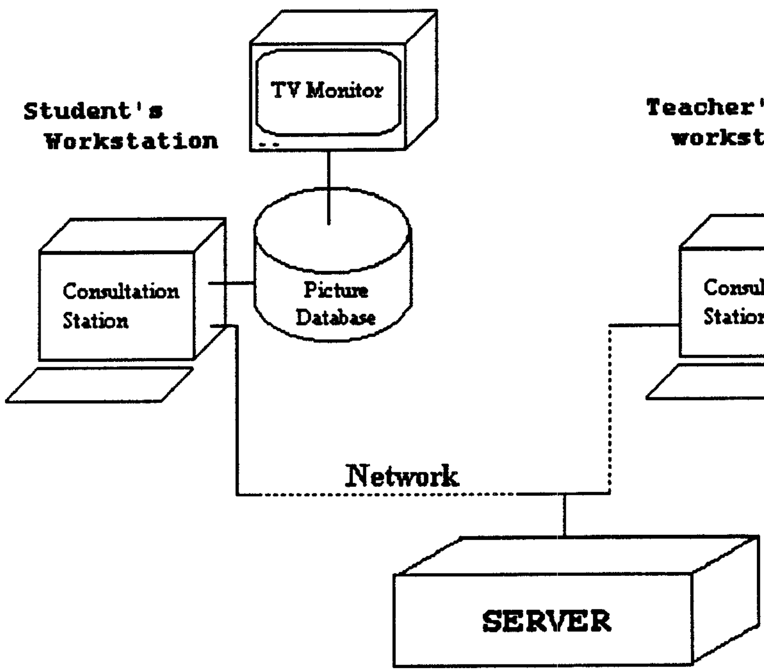
At the third level, teacher and student interact through sophisticated electronic mail. The communication system is a computer coupled with analogical or digital pedagogical resources in a broadly defined network environment (public, private or local network interconnection). This permits interactivity between all users with text, sound or picture objects (all digital), whether or not in real time.

S.T.I.M. Description

As part of a distance education project, we decided to define a Teletraining Interactive Multimedia System called S.T.I.M. It is a teleassistance system for learners in distance personal learning situation. Our system consists in a pedagogical server and several workstations connected to it. Students and teachers



can connect to the server: students in personal training, teachers providing a pedagogical support through the network [BAZ,93].The system architecture is as follows:



The next board sums up the different possible combinations:

Workstation / Network	Consulation Station	Picture database
Ethernet with NOVELL	PC Compatible	Videodisc Player or Tape Recorder
Ethernet with LAN MANAGER	PC Compatible	Videodisc Player or Tape Recorder
Videotex network	Minitel	Videodisc Player

In order to build this system, our principal preoccupations were:

- cost control:

Consultation stations are microcomputers, or minitels. We have deliberately kept two screens, pending normalization of picture digitization. We only use networks for course down loading and for distance pedagogical support.

- an open system to palliate teacher absence, where students can always get help when they are in difficulty, therefore implying minimum changes to teachers' and students' experience.

Functionalities

In the server phase, S.T.I.M. enables a student to get distance self-instruction by taking video courses. As a matter of fact, researches on memorization or on information retention show different results according to the activity and student behaviour; for one message, the message percentage remembered by the student is:

only listening	20 %
only observance	30 %
listening + observance	50 %
listening + observance + interaction	70 %

These empirical observations can be summarized by the Chinese proverb [GUE,93]:

I listen and I forget.

I watch and I remember.

I do and I understand.

If we agree with these observations, we are obliged to admit that multimedia training is an ideal training system. In this training pattern, we not only try to associate text, sound, picture and video, but also to give maximal interactivity between learner and computer. The learner is able to converse with the computer, to train in different situations, according to his wishes and needs.

The system offers two levels of interactivity:

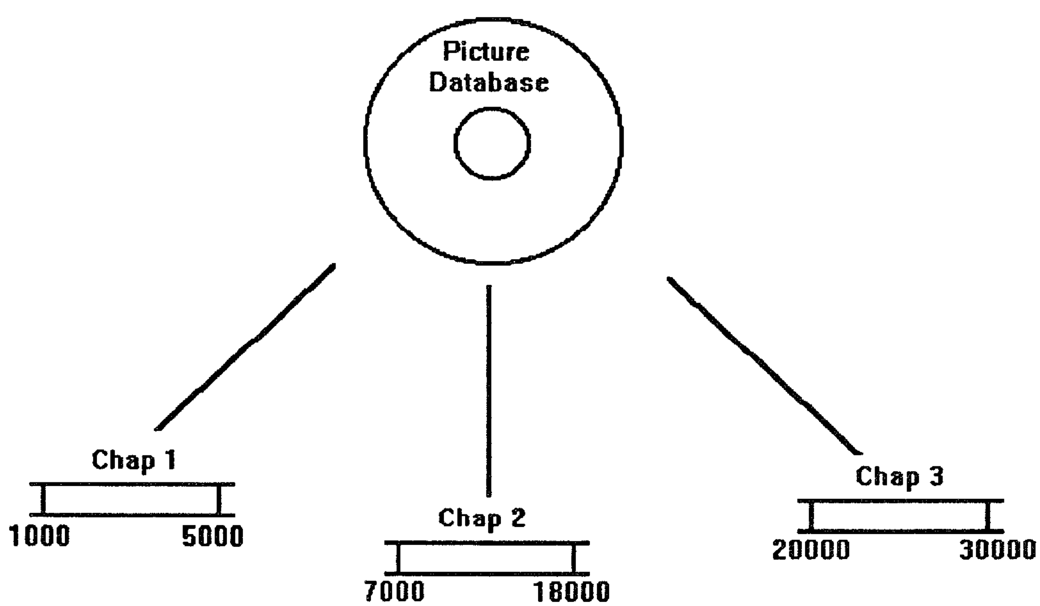
- material interactivity which allows the student to pilot his picture database. He can view several times video sequences he did not understand, make pauses and pass video sequences the contents of which he already knows.

- tutorial interactivity which allows the student to contact a teacher through the communication network. In this manner, they will be able to converse through a "mailbox". Exchanges may concern student problems, or comments (remarks) on the course.

At the beginning of a course session, the student connects to the server from his consultation station and identifies himself, entering his name and his password. He then has to choose a course (in the list he is registered and in accordance with his picture database), and a chapter.

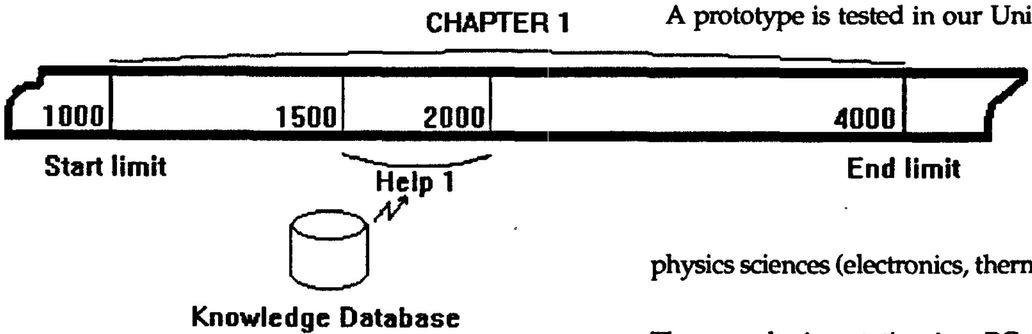
A chapter is a video sequence (with a first picture and a last picture). After selection of the chapter, the server, via the consultation station, puts the picture database on the first picture. From this moment on, the student can have remote control functions on the picture database (play, still, fast forward, fast rewind, ...): this is material interactivity.

Below is a sketch of a course and its chapters:



Video represents about 90 % of the pedagogical contents (this percentage is lower during system exploitation by several students: see further). If the student does not understand video contents, he can ask for two different helps:

- a static help: one or several items of text information are associated to the chapter. In our example, if he asks at picture 1600, text information will appear on his consultation station (at picture 2500 nothing happens). This information comes from the knowledge bank of the server. This bank and the different chapter references are built by a teacher before server utilization (during course design). Below is the sketch of a chapter:



- a dynamic help: he can contact a teacher connected to the Server (on the same course). If a teacher is effectively connected, the student may have the answer immediately; otherwise, his call is recorded in the Server. The dialogue between student and teacher is made by Question/Answer using a multimedia electronic mailbox. All student context is sent to the teacher: when he asks for the question content, his picture database is driven on the picture where the student wrote his question.

If the teacher judges that the student's (remark) question is interesting, he has the possibility to make it visible to all others students in a zone called "forum". Using the system progressively, the forum will fill up and students will be able to consult it before contacting the teacher. According to [DER,91], "distance training systems have to offer communication facilities: the student will be able to contact a tutor, a teacher (courses supported by a computer), but also other students". Our system doesn't allow students' contact other than by the forum: a direct contact should reduce tutor function.

Answering students' questions and managing the forum will reduce to 60 % the video percentage in pedagogical contents and increase to 40 % the help percentage. Moreover, if the same remarks are made by several students on a same course section, the teacher can modify the associated static help or create a new one: a course may always be modified and so enriched.

In the local network version, it is also possible to join one or several multiple choice questions at a precise chapter spot: when the video comes to such a spot, it stops and the question is presented to the student. However, there is no answer management: the student controls his training.

A prototype is tested in our University with two freshmen groups and their teachers. Students can choose several courses in physics sciences (electronics, thermodynamics, ...).

The consultation station is a PC Compatible. The picture bank is a video tape recorder. We keep two screens (the TV monitor and the Consultation Station) for this first experiment, but we could use a single screen with an overlay card.

The network is Ethernet with Novell (it may be the telephone network).

Students' workstations are in the University library. Each teacher has a workstation in his office.

The videocassettes are produced by several teachers in our University. They use a small shooting studio with two cameras and a digital production mixer. The different courses last a maximum of 15 minutes (like a chapter duration). The first camera films the teacher; the second films diagrams presented by him. Teachers use colour codes to build the diagram contents.

Perspectives

Our objective is to use all resources of multimedia in combination with Artificial Intelligence technology.

Multimedia gives us the possibility of managing text, sound and pictures digitally; it permits elimination of the picture database and TV monitor from the workstation. We only keep the computer connected to a communication network.

Artificial Intelligence allows new system developments; learners will have more control upon these systems and their interaction is driven by their needs [MIC,91]. Associated with a hypermedia system, Artificial Intelligence will allow the user to control his training. However, we want to give him the possibility of direct contact with a teacher (as a last resort ?): it is one of the network functions, the other being to allow multimedia data access (they are not always stored on the same workstation). We work in a distributed architecture.

Some problems will occur during the general development of our system. Until now, we have privileged ease of access in the design phase (authoring program) as well as in the utilization phase (courseware). In the first phase, the teacher who builds the course only defines the index and edits multimedia help pages: he uses tools. In the utilization phase, student and teacher are simply interface users.

Using Artificial Intelligence technology, the teacher's role may be upset: all system knowledge must be formalized, especially the definition of courseware parts depending on the application field. These parts include the actual pedagogical material and the teaching strategy [REG,88]. Our will is to limit this upheaval by organizing these parts clearly for the teacher author.

Modifications brought about by digital treatment of pedagogical contents and Artificial Intelligence contribution will not appear overnight. We shall try to keep principles used for S.T.I.M. creation: distance self-training, student's control of his training, maximal use of picture (video), cost control and teacher contact.

Conclusion

The S.T.I.M. prototype tested in P. Sabatier University enables the students to self-train in accordance with their own aptitudes (pre-requisite, learning speed, ...) but they can always contact a teacher to obtain help. Our system evolution will integrate Artificial Intelligence and digital treatment of multimedia databases: it will become an artificial tutor. According to [NIC,88], the system should have a complementary function not that of a substitute; its place is where the teacher cannot meet the requirements of a large number of calls.

Bibliography

[BAT,90]

A.W. BATES, "Application of new technologies in distance education." Perspectives on distance education. Vancouver, 2-6 April 1990.

[BAZ,93]

P. BAZEX, P. BILLAST, C. BOUYSSET, P. CAMPS, "Un système interactif pour l'autoformation multimédia utilisant les réseaux locaux et les réseaux publics.", XII^{ème} Congrès de l'EAO et du Multimédia, Paris, 12-14 Janvier 1993.

[DER,91]

A. DERYCKE, "Réseaux et apprentissage coopératif: vers l'université ouverte de 3ème génération." Colloque SYNAPSE 91, La Grande Motte, 30-31 Mai 1991.

[GUE,93]

L. GUEN, "Problématique de la formation et de l'utilisation des nouvelles technologies éducatives." Cahiers du C.R.E.N., Vol.1, C.R.D.P. Pays de la Loire, 1993.

[LAG,93]

L. LAGIER, E. VERDOIRE, "Méthodes pédagogiques d'apprentissage à distance." Colloque E.S.I.M. 93, Marseille, 18 Juin 1993.

[MIC,91]

A. MICARELLI, F. MUNGO, F.S. NUCCI, "Integrating Artificial Intelligence and Hypermedia for Tutoring Systems." EXPERSYS 91, Paris, 10-11 October 1991.

[NIC,88]

J.F. NICAUD, M. VIVET, "Les tuteurs intelligents: réalisations et tendances de recherches.", T.S.I., Vol. 7, N° 1, 1988.

[REG,88]

J.P. REGOURD, "GAMETE: un système auteur pour l'EIAO." T.S.I., Vol. 7, N° 1, 1988.