

# Technological support for continuous training

Forcheri P., Molfino M.T., Quarati A., Riccio F.  
Istituto per la Matematica Applicata - Consiglio Nazionale delle Ricerche  
Via de Marini 6 - 16149 Genova  
Tel. +39-010-6475-673/5 Fax +39-010-6475-660  
e-mail:{forcheri, molfino, quarati, fratic}@ima.ge.cnr.it

## Abstract.

The continuous evolution in all technological fields asks the personnel of enterprises to keep up to date their knowledge, that is, to carry out a continuous learning process. As it has been already noted, network based training systems can offer an efficient solution to this problem.

On this basis, the European Community launched a series of initiatives to support projects aimed to explore the possibility of helping SMEs, which constitute the core of our economy, to adopt these kinds of training models.

Our work is framed in this context. In particular, we developed Qualification 2000, a project partially funded by the European Community under the Adapt initiative, aimed to analyse, from an operative point of view, the potential of new technology for realising effective continuous training in SMEs. The target of the project are staff of SMEs, which are to be trained on the changes that new information and communication technology has brought to the office.

Within this context, we developed a net-based training model endowed with two main features: 1) the methodological guidelines of the model are based on a need analysis, to give effective response to training needs; 2) two different implementations have been realised, in order to adapt the model to different technological situations. The model will be analysed in this paper.

## 1. Introduction

Information and communication technologies are a driving force behind innovation, both in processes and outcomes. It is therefore important to raise people's awareness of technology and to train them not only in its use but also in the transformation of the job world brought about by technology [5,6]: this is vital to personal growth and to the development of innovation in small and medium sized enterprises.

Consequently, effective training models must be designed to help enterprises to improve technical and cultural understanding, permitting them to meet the challenges of technological development and to adapt to the changes this will bring about in the organisation of work and production [7].

Several problems underlie the design of these models. On the one hand, employees have to learn new contents, as automation and communication tools, working methods, as collaborative and team work, and to change their working habit, as to show initiative and flexibility, to be able to take responsibility. On the other, the production obligations of the enterprise greatly affect the possibility of planning traditional training activities.

In this context, multimedia and networked educational tools seem to be a valuable answer to these opposite needs [3].

According with these ideas, we developed a project, called Qualification 2000, supported by the Adapt initiative of the European Community and by the Italian Ministry of Labour and Social Security. Italian partners of Qualification 2000 are Ligurian associations and enterprises. The project, ended in February 1999, focuses on the use of advanced educational technology for continuous training on the changes in information management and communication that new technology has brought to the office [8]. The target are staff members of small and medium enterprises (SME) who face redundancy, in particular women.

Within this context, we developed a net-based training model endowed with two main features: 1) the methodological guidelines of the model are based on a need analysis, to give effective response to training needs; 2) two different implementations have been realised, in order to adapt the model to different technological situations. The model will be analysed in the following section.

## 2. The educational project

In the literature several experiences regarding the use of communication technology for training are described [1,2,4,10,11,13]. These experiences, which mainly concern large and technologically advanced enterprises and higher education centers, are quite promising and show the potential of new technology as a means to give impulse to continuous learning. Thus, it is of great interest, at least in the European realm, to explore the feasibility of extending these kinds of training models to small and medium enterprises (SMEs), which constitute the core of our economy. This extension is difficult to realise for several reasons, mainly variety and economic situation of SMEs. Consequently, training project based on the use of network resources and devoted to these kinds of enterprises require a careful analysis of their problems, in order to determine solutions which respond to effective needs.

With these ideas in mind, we carried out a series of interviews to both employers and employees of SMEs. We interviewed a number (20) of enterprises, representatives of the economic situation of Liguria, a region in the north-west of Italy. The interviews aimed at knowing the expectations and attitude of both employers and employees towards training on advanced technology and its applications into the office. The results of the interviews, which are analysed in detail in [9], highlighted a core of common problems, in particular: the limited resources (in time and money), that can be dedicated to training; the necessity of individualising the learning path and that of tailoring the teaching strategy to the personal attitude of the trainee, the need of training people to use technology as a means to co-operate and to develop initiative. These problems form the experimental basis of our educational project.

Accordingly, the methodological guidelines governing the proposal are as follows:

1. *To integrate different teaching/learning strategies*, in order to take into account the personal attitude of the employees towards the machine and their personal problems of relationship with colleagues, to help employees to develop autonomy and initiative, and to acquire the capability of interacting and co-operating with colleagues, to limit problems of time. Notably:
  - To guide and give motivations for self-learning, by combining self-learning activities with a distance training system.
  - To give the trainees the possibility of establishing personal relationships with the trainer (exchange of one-to one messages, possibility for the trainee to ask questions privately, etc.). To allows all participants to share the problems come out of these individual activities, the trainer has to create and manage a list of frequently asked questions; moreover, if it is the case, an electronic forum for discussion can be organised.
  - To develop a collaborative approach to learning, in order to help employees to develop autonomy and initiative, and to acquire the capability of interacting and co-operating with colleagues. Co-operative activities (problems and exercises) regarding specific contents are proposed adopting distance learning techniques (learner to learner, group to group, general discussion etc.). These activities are designed to increase flexibility in working strategies, promote innovative work methods, stimulate learning, and develop comparative skills and constructive communication with the outside world that will encourage creativity.
2. *To teach content using a design and problem-solving approach*, in order to render people aware of the potential of technological innovation in their job. Notably:
  - To introduce topics in the form of problem-solving tasks; these lead to the identification of practical and conceptual tools which can be used to solve the task via sequential abstraction. This helps develop thinking skills and promote active and responsible participation.
  - To present specific applications as practical examples of conceptual tools; this makes acceptance easier and facilitate the autonomous transfer of skills acquired in one application to another.
  - To encourage a strategic approach to all tasks, including routine ones, by placing stress on the decision-making process and giving practical examples of how technology can support this process. This helps to increase motivation, as well as promoting awareness of the new technology and a confident approach to it.

### 3. The computer based model

To realise the above ideas we designed a computer based training model organised into two parts: a set of multimedia courses and a communication environment. These parts are integrated in a distance learning environment.

The set of courses helps trainees acquire knowledge and abilities about information management in the office, while the communication environment allows them to get in contact with one another and with the (distant) trainer in synchronous or asynchronous mode.

By integrating these two parts, the distance learning environment allows trainees to develop, with respect to a given content, different learning paths in a unique context: self-learning, collaborative learning and distance learning with the guide of a trainer (see Figure 1).

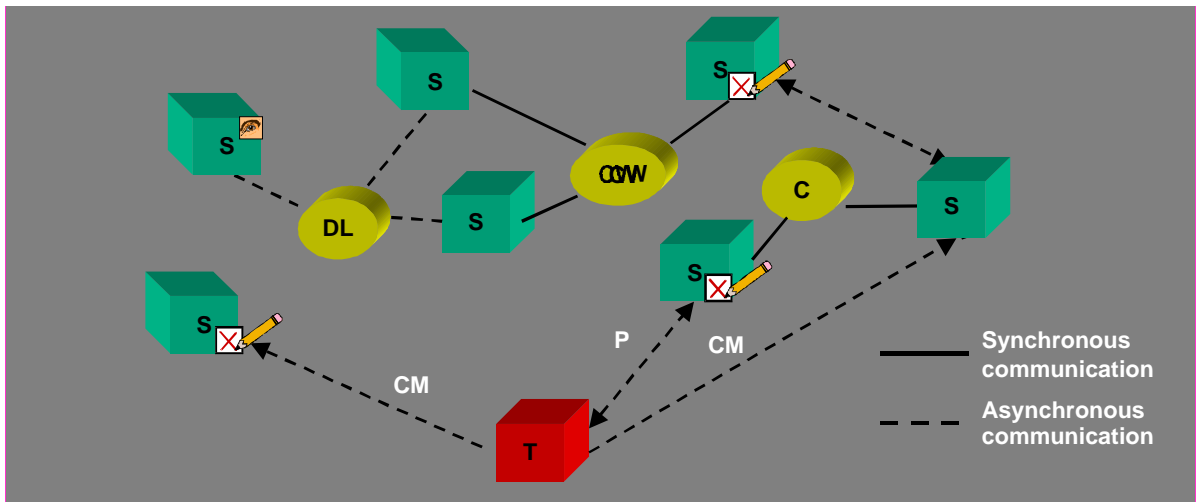




Figure 1 - The scheme represents the learning activities carried out by students (S boxes) and trainer (T box). Each student joining the course (seated at his/her PC), may read a text  or solve a problem . Moreover, he/she can communicate with the distant trainer T privately (double arrow labelled P) and to get new course material and assignments (arrow labelled CM). Finally, each student can carry out collaborative activities ("oval" boxes): co-operative solution of problems and exercises (CW), participation in discussion lists (DL), or on-line discussion (C).

#### 3.1 The courses

Five multimedia courses have been developed, regarding, respectively: graphic management systems, spreadsheets and numeric data management, database, development and presentation of textual information, the network and its organisation. The topics of the courses were chosen to meet a dual need: a) giving participants the kind of general knowledge that will help them gain awareness of technological evolution and its impact on the social-economic situation; and b) providing tools and practical knowledge that allow participants to integrate new skills with those already mastered, so that they will be able to manage transformation in the workplace brought about by the introduction of advanced information technology.

The teaching/learning philosophy of the courses takes into account the results of the interviews and the observations about previous training experiences. Accordingly, in our courses:

- Concepts are introduced starting from typical problems of office world, gradually deepened during the solution of the problem itself and independently, as much as possible, of a particular application software.
- Demos are provided showing solution steps of problems.
- Activities in group and individual exercises are proposed. The exercises are mainly meant to be used for self-evaluation.

- Exercises are highly interactive. They mainly consist in problems, which must be solved manipulating objects on the screen.

### 3.2 The communication environment

The communication environment consists of a computer conferencing system made of two components: the learner component and the trainer component.

- *The learner component* aims at being used for distance learning with the guide and assistance of a trainer and for carrying out collaborative learning experiences. It includes a synchronous conversation module, which allows interaction among many persons online at the same time, and an asynchronous communication module, which allow to deliver private and public e-mail. Synchronous conversation is used to encourage learners to carry out co-operative during consultation of a course (to discuss about a specific point, to solve an exercise, to ask for an explanation, etc.). To facilitate co-operation, when the user asks for connection, the screen is horizontally divided in two parts: the first one is used to type in, while, on the other part, the user can see the contributors to the on-going conversation and their messages, sequentially. Asynchronous communication is mainly intended at being used for assignment feedback, to ask questions to the (distant) trainer, to take part in discussions with the colleagues, etc. Accordingly, asynchronous communication comprises the possibility of delivering private messages (via an electronic mail facility) and that of sending contributions to public discussions, moderated by the trainer (via a discussion list facility). Via public discussions the learner can ask for off-line help from the trainer and the colleagues, send (or answer to) requests of material, propose the exam of topics of particular interest, take part into the general discussion of specific points proposed by the trainer, read a brief explanation – given by the trainer or a colleague - on a topic of particular difficulty, think about and propose its solution to a problem, etc. Via e-mail the learner can establish a personal relationship with the teacher, for example he/she can ask the trainer for a particular explanation, enter in detail in specific difficulties he/she does not like to communicate to colleagues, send the trainer his/her solution to exercises; he/she can receive assignments, feedback and suggestion tailored to his/her specific needs. Via e-mail, moreover, the learner can keep in touch and work with a selected group of colleagues, for example to carry out group work, to prepare reports on a shared activity, to exchange material, etc.. Finally, e-mail allow learners to receive the classroom material, such as the text of a lecture, explanations, assignments and solutions of previously proposed exercises.
- *The trainer component* is to be used for the management of the multimedia courses: the trainer organises the trainees in virtual classrooms, independently on each other or interconnected, according to their needs. The control of the educational activity is carried out via a graphical interface which allows the trainer to monitor (in both synchronous and asynchronous mode) the consultation of the multimedia packages, to manage the discussion lists, to send and control exercises and tests.

## 4. The implementation

Two different implementations of the model have been realised, the first one aimed mainly to be used locally, the second one aimed at being used in a context of distributed training.

The first implementation consists of four multimedia packages, which can be used stand-alone on a PC, for self-learning, or on a PC LAN, to carry out collaborative learning and guided

The packages share the organisation of the interface and the general structure. In particular: activities, in synchronous or asynchronous way (see Figure 1). In fact, from each package, the trainee in every moment, can display the list of all the users which are working on the same course and enter in touch with them. Moreover, he/she can exchange e-mail with the trainer or other colleagues.

- The interface is very simple. Its elements are very few, all of which are self-explanatory. Each screen is divided into two parts: the working space, and the bar of the buttons which allow navigation and communication with the outside. To proceed through the course and access the various possibilities the user only has to push buttons and «hot» words.
- The working space is divided into two parts: the *lesson space*, and the *simulation environment*. The *lesson space* always contains a brief explanation, and two buttons, named DEMO and PRACTICE, one which

displays a demonstration and the other the text of an exercise. The *simulation environment* is used to show the demonstrations and to carry out the exercises.

- Feedback is always provided.

Figure 2. An interaction during a self-learning session

The second implementation consists in a web-conference framework which supports the delivery of courses via Internet, and of a course, developed within this framework, aimed at being used on an heterogeneous network, for self-learning. The course regards the concept of network of computers and focuses on Internet/Intranet technology (see Figure 3). During consultation, the learner can access to the communication module by means of Java applets contained in the HTML pages visualised. Java applets are also employed to implement the processes simulating the activities showed in the course.

These different implementations aim to give answers to different enterprise needs. In fact, as it has been already observed by other authors [12,14], although technology plays a key role in the realisation and delivery of computer based training, educators must remain focused on learning outcomes, not on the technology. The key to effective educational technology is focusing on the needs of both enterprises and learners, on the requirements of the content, and on the constraints faced by the environment. Using this integrated approach, the educator's task is to carefully select among the technical options, meeting the needs in a manner which is instructionally effective and economically prudent.

Our technical choice was made accordingly. In particular, it allows us to employ the same model in different technological situations to solve different educational problems. On one hand, we realised a local application on a PC LAN to give an answer to the need of learning office automation concept to be applied in a PC/Windows environment, taking into account that this need was mainly expressed by enterprises with a limited level of technological resources and which cannot effectively access the web. This choice, moreover, does not limit the application field of our training product. On the other hand, we propose distributed training for a heterogeneous computer network for educational topics, such as networking, which are intrinsically general with respect to the hardware/software platform, and are supposed to be of interest for enterprises oriented towards a net reality.

Figure 3. Co-operative learning using discussion lists

## **5. Conclusions**

Human resource development and constructive collaboration between research and production world are fundamental in order to maintain the occupation level and to increase competition of SME. Qualification 2000 constituted for us a valuable occasion to work in these directions. The topic of the project, that is the analysis of the potential of new educational technologies for continuous training in SMEs, allowed us to transfer research ideas and results on both learning problems and teaching methods to the enterprise world. The involvement of enterprises in the project was for us an operative occasion to orient research towards innovation and to build a training model which adapts research ideas to actual needs. This co-operation was fruitful also for companies: the comparison between their experience and the approach to problems typical of the researchers helped enterprises to recognise the aspects of the research proposals which help to increase productivity and improve quality of their work.

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