Telematics and on-line teacher training: the POLARIS Project

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Abstract The link between distance learning and telematics is becoming ever stronger, yielding new solutions to old problems, innovative educational resources and new teaching/learning models. One of the most innovative and promising fruits of this relationship is on-line education, notably a process whereby all the participants (teachers, tutors and students) are linked up in a computer network; the effect of this is the creation of a fully-fledged learning community in which all individuals take an active part and make a valuable contribution to the group. The aim of the paper is firstly to outline the distinctive characteristics of on-line education methodology and secondly to examine the POLARIS project, which proposes an experimental approach for in-service teacher training based on intensive use of computer mediated communication according to the principles of on-line education.

Keywords: Computer-mediated communication; POLARIS; Teacher training;

Context

Over the past century, the steady evolution in communication technology (transport, telecommunications, etc.) has considerably influenced the parallel development of Distance Education (DE) systems (Nipper, 1989). The earliest significant application of DE methods (first generation distance education) dates back to the end of the nineteenth century, when new printing techniques and the development of the railways allowed the production and widespread distribution of learning material for students scattered over vast geographical areas. This largely consisted of correspondence courses based on printed material, and student-teacher interaction was conducted at a snail’s pace if at all. These courses were usually limited to the exchange of papers such as test sheets and to extremely infrequent face-to-face meetings.

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This first generation of DE systems was superseded in the 1950s by the so-called multimedia or second generation DE systems, which incorporated various media, like printed material, television programmes, audio recordings and, in some cases, educational software (courseware). Teacher-student interaction remained virtually unaltered from the first generation, even if supported by the telephone, face-to-face tutorials and, more recently, fax and email links.

Thus first and second generation DE systems were based primarily on production and distribution of learning material for the learning community. Communication with the student (conducted bi-directionally) only played a marginal role, while communication between students was virtually nonexistent.

From this perspective, DE seemed merely to be conceived to bridge geographical distances, a problem that can be solved by effective presentation and distribution methods. Hence education was no longer seen as a social activity centred on student-teacher interaction but rather as an almost totally individual pursuit. The distinctive element of these virtual classes was that they were spread over a wide geographical area; the socio-cognitive potential inherent in traditional classes was totally lacking.

The driving force behind the development of third generation DE systems is the redefinition of learning as a social activity, albeit performed at a distance with the inevitable mediation of technology. In DE terminology, third generation systems are also known as on-line education, a definition that gives a clear idea of how extensively the computer network is used in the learning process; participants interact in a fully-fledged learning community, which helps them overcome their isolation and enhances their contribution to the group.

This approach is particularly suited to adult education, where swapping personal experience about the topic being studied can play an essential role in collective development. What is more, within a framework of close interaction between participants, a number of established collaborative learning strategies can be called upon such as peer learning (Damon, 1984), reciprocal teaching (Brown & Palincsar, 1989), techniques using the jigsaw method (Aronson, 1978), and the like.

On-line education and traditional distance education

The most striking characteristic of on-line education is course flexibility. Through frequent inter-student and student-tutor exchange, tutors have the opportunity to monitor both the overall progress of the course and knowledge acquisition by each individual participant, more or less in real time. This allows a sort of running evaluation of the students and the course itself, permitting tutors to modify, reinforce and model educational processes. In this way, tutors can meet the learning and cognitive requirements of each participant, requirements that can be gleaned on a daily basis from network discussions.

Traditional DE courses are considerably more rigid given that the learning material has been designed and structured for individual use within a specific
time frame. Moreover, with interpersonal communication confined to sporadic exchanges between tutor and students, it becomes extremely difficult to introduce new learning material and topics, or to modify parts of the course. Therefore, there is little scope for any modification that may be needed to adjust the course to the participants’ different learning styles, or cultural or professional background, and so forth.

Another key feature of on-line education is the possibility of creating virtual classrooms where a group of participants may ‘meet up’ to discuss particular aspects of the course. This lays the ground for groups to work in parallel, or for continuing a discussion on units of the course already covered without interfering with the schedule set down by the tutors. Anyone interested can stay in the virtual classroom while the others carry on with the work at hand.

The technology generally used for managing on-line education comes under the category of computer conferencing (text-based conferencing), which creates fully-fledged distributed learning environments that overcome the hurdles of time and space. Computer conferencing opens up a whole new range of possibilities for managing and participating in the educational process, benefits that neither traditional DE approaches nor conventional face-to-face courses can offer. While the face-to-face approach favours many-to-many interaction the necessary physical attendance by all participants poses time and space constraints. Conversely, traditional distance learning overcomes space/time hurdles but is nonetheless biased towards two types of interaction: one-to-many (teacher/students) or one-to-one (student-teacher). In practice, theoretical and practical models that address one or the other of these domains cannot, when considered individually, cover all the learning and interpersonal communication needs that distinguish on-line education. In this light, Harasim (1989) shows how distance learning may be seen as a ‘unique domain’.

Computer conferencing and, in more general terms, computer-mediated communication (CMC) not only offer asynchronous, many-to-many communication but also make full use of interaction via the written word. This is actually a fairly informal style of communication (so called ‘say-writing’), which reproduces spoken language in written form. Peer interaction produces a number of benefits for the learning process, especially when conducted in written form (Mason, 1993). Formulating one’s ideas and setting them down in writing is a major cognitive skill, as is considering and responding to the ideas of others. In addition, active participation helps to enrich the learning environment, allowing each participant to consider the topic under discussion, or a difficult situation, from different viewpoints, namely those of the other participants. However, it must be remembered that designing and running an on-line CMC-based course means adopting a series of methods and measures that differ considerably from those used either in traditional distance learning or in face-to-face instruction.
Another interesting aspect of computer conferencing is its capacity to promote and support collaborative learning activities. In fact, the computer conferencing environment favours a kind of learning based on collaboration between all the actors in the learning process — learners, tutors and experts. Using this approach, each member of the learning group can help define what is being learnt; this is a key activity in that it brings to the fore a variety of viewpoints and highlights the range of opinions about a single event or topic (Kaye, 1992). It does not matter if this leads to disagreement, because the disparity of opinion itself stresses the very complexity of many knowledge domains. In collaborative learning environments, the learner, when called upon to address and solve a problem, is able to identify and take full account of all the various points of view.

The ability to take full account of the point of view of others when addressing a problem or situation is undoubtedly a key factor in much in-service training. Traditional distance learning courses have often neglected this factor, making little use of the knowledge, ability and experience that each learner brings with him/her, an asset that can be shared where the participants are connected up in a network (IET-OU, 1994).

When the extraordinary information resources available on the network are added, the difference between conventional distance learning and on-line education becomes even clearer. Up to this point the network has only been considered as a vehicle for interpersonal communication, but it is also an incredible source of information, material and knowledge. Put to good use, these resources may help to further enrich on-line education courses and, in a broader sense, lifelong education (Trentin, 1996a).

However, caution and guidance are needed in using this wealth of information. Students and teachers may well be free to set off in search of information and knowledge, but if they are to make sensible and profitable use of the network for educational purposes they require some preparation. First they need to acquire specific skills in utilising the network, identifying the most suitable and authoritative information sources, and learning how best to exploit the information collected, otherwise they run the risk of wasting considerable time and energy for little return (Trentin, 1994).

The POLARIS project for on-line teacher training

A joint study has been developed to examine the educational potential that telematics can offer in-service teacher training. The two partners involved are the Italian Research Council’s Institute for Educational Technology (ITD) and the Technical Education Board (Division II) of the Italian Education Ministry (MPI).

The main aim of the project, known as POLARIS, is to define a special model for in-service teacher training based on intensive use of telematic resources, along the lines of the on-line education approach, otherwise known as third generation distance learning. Actually, the model is not confined to the training stage, but also includes follow-up on-line support for trainees. This will bring
about a more effective transfer of knowledge learnt in the course to the classroom context. Hence the proposed model envisages two main stages:

**on-line education + on-line support and counselling**

*Specific project goals*

Through a series of pilot activities the project aims to:

- define the proposed model in methodological terms (on-line education + on-line support and counselling) and ascertain its effectiveness by delivering a series of courses based on that model;
- design a teaching package based on on-line education for ‘on-line tutors’ (a role of vital importance in any on-line course), and ascertain its effectiveness in a pilot course;
- outline the criteria for engineering the model to allow autonomous management by MPIs of both tutor training, and the design and implementation of further on-line courses.

It should be noted that POLARIS will not adopt the ‘cascade’ approach to tutor training, i.e. training an initial group of tutors who then go on to teach other trainees in the same methodological/disciplinary context and so on. The tutors in POLARIS follow a particular method for designing and running their on-line education courses, which have contents that may vary (and have varied) and are not necessarily linked to their particular area of competence.

*Project phases*

The first year of the POLARIS project was divided into three main phases:

- creation of a communication infrastructure for conducting on-line training courses;
- distance training of a group of 10 tutors in methods for planning and managing on-line training courses;
- distance training of 10 groups of teachers (totalling approximately 50 people) on the subject of network-based education.

**Phase 1: Communication structure**

The development of a communication infrastructure to permit experimental delivery of the early on-line training courses involved: design and construction of a computer conferencing environment hosted on and managed by an ITD server; and identifying an Internet Service Provider for each of the course participants to enable them to have access to the network at local telephone rates.

Communication between participants was handled by a computer conferencing system called POLARIS FC. Developed using FirstClass software (produced by SoftArc), this system features a simple graphic interface and offers the user a series of advanced interpersonal communication functions such as email, bulletin boards, file transfer and real-time chatting.

POLARIS FC users have direct access to the information that interests them most and are not disturbed by all sorts of messages, a common problem with
email. POLARIS FC resembles bulletin board systems (BBS) in that communication is organised into themes, or conferences. Messages are not sent to a single mailbox but are arranged by the users and the moderator in specific niches. This means that when users select a particular area, they will only see conversations related to that topic.

Phase 2: On-line tutor training
The on-line tutor course drew on the British Open University’s Teaching and Learning On-Line (TLO) course, although extensive modification was required in order to tune it to the Italian context and adapt it for use with upper secondary school teachers.

The course centred on the special features of third generation DE systems and was designed for 10 educators with previous experience in face-to-face tutoring. The prime objective was to train these tutors in the design and running of on-line courses in order to create a pool of tutors to be used in later phases of POLARIS for co-ordinating on-line training activities on methodological/subject themes.

A secondary objective in this phase was to raise the participants’ awareness of the potential limits and problems involved in running distance courses based on intensive use of network technology. This caution is a response to the considerable hype surrounding use of the ‘information highway’ for distance education: unfamiliarity with the computer as a distance learning resource is bound to pull the rug from under many grandiose theoretical constructs (Trentin, 1996b).

The tutors were trained over a three-month period by ITD researchers; after a two-day face-to-face induction meeting, the remainder of the course was entirely on-line.

The on-line tutor course
The main goals set for participants in the on-line tutor course were to:
• develop skills in initiating and moderating on-line discussions and group work relying on asynchronous text-based communication;
• gain familiarity with the most widely used Internet services;
• know how to combine telematic resources with other media and methods (face-to-face activity, printed material, courseware, audiovisual systems, etc) when engaged in network training activities;
• be able to identify the pros and cons of using computer conferencing and network resources in training courses, both in general terms and in the particular contexts in which the participants may be called upon to operate as tutors.

Breakdown of the on-line tutor course
The course was divided into four stages of varying duration, each comprising a series of modules that lasted from two to five weeks. Areas covered in the various stages included: familiarisation with network services relevant to course
activity; learning the methods and strategies which were proposed for correct use of CMC in distance learning; development by individual course participants of original projects (the On-Line Tutor Course was project-based) in which the knowledge acquired during the course could be put into practice.

Each course stage contained strong operational and communication elements: individual work such as reading, planning etc., alternated with interaction with other participants (fellow students, tutors, experts).

**Evaluation of the participants and the course**

The participants who received a positive assessment were those who took an active part in group discussion, handed in a weekly report to their tutor about their progress in the course, undertook the tasks linked to the various stages, and who developed a mini-project on the application of CMC to in-service teacher training.

Evaluation of the course was carried out by ITD in conjunction with an assessment panel appointed by the Ministry of Education’s Directorate of Technical Education. Both qualitative and quantitative evaluation were performed. The former was based on observation and classification of the messages exchanged by the course participants (Henri, 1992; De Vries et al., 1995), as well as on analysis of the tasks completed at the end of each stage. The latter focused on communication flow and dynamics using sociometric analysis techniques (Schutzenberger, 1972).

A further evaluation criterion for assessing both participants and the course itself was observation and analysis of results gained in Phase 3, the stage when the newly-trained tutors were called upon for the first time to design and conduct an on-line training course: this meant putting into practice the knowledge acquired in the on-line tutor course.

**Phase 3: Putting the newly-trained tutors into action**

The main aim of Phase 3 of POLARIS was to put a group of newly-trained tutors to the test by calling on them to design and conduct an on-line training course. In this way it was possible to evaluate the progress that each individual tutor had made and assess the educational effectiveness of the on-line tutor course they had taken.

To these ends, four of the 10 newly-trained tutors were involved in the design, creation and running of an on-line course for groups of teachers located throughout Italy. The subject was the use of network communication resources (like the Internet) in education and the course was called T&D. In this first actual experience of on-line education, the tutors were supported by ITD researchers, who offered their expertise in content matters and helped the tutors learn the ropes.

It should be noted that the T&D course was designed entirely on-line as the tutoring staff and the experts were spread throughout the country, the former located in Genoa, Rome, Modena and Verbania, and the three experts in Genoa and Palermo.
The T&D on-line course

The T&D course involved 50 upper-secondary school teachers from all over Italy. The themes covered were familiarity with the major educational applications of telematics and criteria for designing and conducting network-based education activities.

The teachers came from ten different technical schools and were divided into learning groups (five teachers per school/group). The members of each group all belonged to the same class advisory panel * . This was dictated by the need to launch small on-line learning projects of an interdisciplinary nature as a follow-up to the training course.

As in the On-line Tutor Course, the teachers were trained over a three-month period; after a two-day face-to-face induction meeting, the remainder of the course was entirely on-line.

Specific goals of the T&D course

The specific goals pursued in the T&D course were: becoming acquainted with the major network tools and services; using the Internet to support educational activities; design and management of network-based educational activities.

Course organisation

The course was divided into two levels of difficulty to account for variation in the teachers’ degree of familiarity with network services. The first level was of medium-low complexity, ensuring that all participants would attain the minimum required objectives. The second was aimed at more experienced participants and was organised into a series of specialised workshops so that the various aspects of the course could be examined in greater depth.

Evaluation

The same criteria adopted for evaluating the on-line tutor course were applied to assessment of both the T & D course and its participants. Evaluation was two-tiered: evaluation of the teacher training process (during the three-month course), and evaluation of the teachers’ ability to transfer knowledge acquired in the on-line course to the classroom.

Impressions of the participants in the on-line tutor and T&D courses

At the end of the courses, the participants were asked to evaluate their own participation by completing a questionnaire. The most significant findings are given in Table 1, with ratings expressed on a scale of 1 to 5.

Some of the points that the participants identified as more negative were:

• the workload that was involved in the on-line training course;
• the bulk of messages generated in the various conferences;

* In Italian schools each class has an advisory panel comprising all the teachers that work with that class, as well as parent and student representatives.
• the need to work mainly from home;
• having to attend a face-to-face meeting halfway through the course;
• the lack of breathing space between the various stages to allow everyone to reflect and fall back into line with the group.

### Table 1. Average ratings on end of course questionnaires

<table>
<thead>
<tr>
<th></th>
<th>On-line tutor course</th>
<th>T&amp;D course</th>
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<tbody>
<tr>
<td>How would you rate your participation in the course?</td>
<td>4.1</td>
<td>4.2</td>
</tr>
<tr>
<td>Did the course content meet your expectations?</td>
<td>4.0</td>
<td>4.1</td>
</tr>
<tr>
<td>Was the content dealt with thoroughly?</td>
<td>4.1</td>
<td>4.1</td>
</tr>
<tr>
<td>To what extent do you think CMC may support collaborative learning?</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Did you find the group and sub-group interaction constructive?</td>
<td>4.4</td>
<td>4.1</td>
</tr>
<tr>
<td>To what extent do you think that such a course would be feasible for teachers in your school?</td>
<td>3.5</td>
<td>3.6</td>
</tr>
<tr>
<td>How effective do you think on-line education is for in-service teacher training?</td>
<td>4.0</td>
<td>4.1</td>
</tr>
</tbody>
</table>

As the evidence shows, participation in POLARIS was considered favourably by most of those involved, even though some parts of the model require revision and improvement. This will allow the course to be more responsive to teachers’ requirements, which chiefly concern striking a balance between professional commitments and the schedule of on-line activity necessary for collaborative learning.

### Conclusions

The main aim of an on-line course is to bridge the geographical and socio-cognitive distance between individual students and all the other components that are involved in the educational process — tutors, experts, other students, educational material, and so forth. The intensive use of computer conferencing in particular and computer mediated communication in general can reduce and in some cases even eliminate this distance and can make the educational process considerably more flexible. The use of the computer network combined with the kind of methodological approach outlined in this paper will not only reduce the costs of producing learning material, but will also make it easier and quicker to update and tailor it to the needs of the learner, a key requirement in the field of in-service training.

It is only recently that experiments with educational models based on third generation distance education systems have been undertaken in Italy* . While they remain few in number, we can nevertheless begin to analyse the suitability of this methodological approach. In this respect, POLARIS is expected to play a leading role in the testing and evaluation of on-line education for in-service teacher training.

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* One worth mentioning is MEDEA, an on-line course in the design of environmental education projects (Briano, Midoro & Trentin, in press) developed within the LABNET project (a collaboration between CNR-ITD and the Italian Ministry for the Environment).
References


