Computer Mediated Communication and Online Teacher Training in Environmental Education

RENATA BRIANO, VITTORIO MIDORO & GUGLIELMO TRENTIN
Consiglio Nazionale delle Ricerche, Genova, Italy

ABSTRACT This paper describes how certain aspects of on-line education can benefit teacher training in Environmental Education (EE) subjects. On-line education differs from first and second-generation Distance Education systems in that participants glean new knowledge from interaction with one another, and this factor offers enormous potential in EE. In fact, EE aims include the development of problem solving, decision-making and teamwork skills. MEDEA, an on-line teacher training course on a methodological approach to design and realise EE projects in Italy, is presented as a case study. This paper describes both the structure of the course and how it was carried out. The results and the lessons learned are discussed.

Introduction

One of the central issues in the field of environmental education (EE) is that of teacher training. The question here is: what skills and knowledge does a teacher need to have in order to take part in an EE project? What expertise is the teacher expected to have? This leads us straight to another question: what characteristics must a successful EE project possess? It would take a lengthy dissertation just to answer these few questions. In this report we wish to limit our focus to those aspects of the teachers’ expertise in EE, which can benefit from on-line education methods.

There is wide consensus that the study of EE in schools ought to be carried out through interdisciplinary projects addressing an environmental issue. Hence teachers will no longer work in isolation, but must learn how to co-operate within a project group and master the basic design techniques common to any system (Riel, 1992). Therefore, training courses must cater for prolonged interaction; the use of telematics can foster this by removing space and time constraints. Computer Mediated Communication (CMC) is largely text-based and asynchronous (deferred time). This purely
technological factor has an enormous impact on the way communication is conducted. While no in-depth studies have been carried out into this aspect, there is little doubt that, when working in a group, the need to communicate in writing in deferred time involves a much greater degree of synthesis and clarification than in face-to-face oral communication (Mason, 1993).

In EE projects there is a constant risk that the isolation in which teachers work will lead to fragmentation and end up limiting project scope. An EE teacher should feel part of a wider community that, while operating locally, has a solid general base. On-line education helps to overcome teachers’ isolation by linking them up in an on-going manner, even though they may work in separate geographic locations. With on-line training courses, teachers involved in projects become aware of the possibilities offered by interaction and collaboration not just with colleagues in their own school, but also with those working elsewhere.

The isolation faced by teachers also hinders their access to information sources and to sites where knowledge is generated. Participants in on-line training become aware of the possibility of accessing authoritative sources (experts, professionals, etc.) and information. Even when the course is over, the teacher can keep a channel open with the tutor and other participants, thus reinforcing that sense of belonging which is often lacking in conventional training courses (Trentin, 1996a). Moreover, the rigid scheduling of conventional school activities hinders group members seeking to work together in a flexible manner. In this respect, on-line training courses present participants with the means to tackle time restraints through the use of deferred written communication.

An important aspect of EE is to reflect on what one is doing, bearing in mind the implications this action may have on the process as a whole. Interaction that takes place in an on-line course is constantly available in written form, presenting a potentially powerful tool for analysis, review and synthesis; this fact alone would justify using telematics in teacher training.

Being able to address both educational and environmental problems, while taking the points of view of others into account, is a vital factor for in-service training in the EE field. In conventional distance education this aspect has often been neglected, with little use being made of the know-how and experience each participant brings to the course. In network communication, on the other hand, this resource is fully tapped.

Sharing personal experience related to the subject being studied can play a key role in the collective growth of the group. For this reason distance education (DE) methods are particularly suited to adult education.

These are some of the aspects that make on-line education attractive to teachers who are developing EE projects. In this paper, we shall present a warts-and-all examination of an experiment in on-line education, covering the technological and methodological context in which it was carried out, the
approach adopted and the results obtained (both good and bad). Our hope is that this will help anyone taking on a similar project.

**Technological and Methodological Scenario**

The driving force behind the development of third generation DE systems is going to be the redefinition of distance learning as a social activity (Nipper, 1989), albeit performed with the inevitable mediation of technology. In DE terminology, third generation systems are also known as on-line education, a definition that clearly stresses the prominence of the computer network in the learning process; participants interact in a fully-fledged learning community, which encourages individuals to overcome their isolation and enhances their contribution to the group (Trentin, 1996b).

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 running evaluation of the students and the course itself, permitting tutors to modify, reinforce and model educational procedures. 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 discussion.

Traditional distance education courses are considerably more rigid given that the learning material has been designed and structured for individual use within a specific time frame. What’s more, with interpersonal communication confined to sporadic exchanges between tutor and students, it becomes extremely difficult to introduce new 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, cultural or professional backgrounds, etc.

In short, it could be said that the special features of on-line education derive in part from face-to-face teaching, in part from traditional DE and in part from a combination of the two approaches (Harasim, 1989). Much like face-to-face teaching, on-line education tends to shift the focus back to the social rather than individual nature of the teaching/learning process. This is thanks to the many-to-many interaction typical of computer conferencing. On the other hand, based as it is on deferred distance communication, on-line education also presents some of the typical characteristics of traditional DE such as freedom from space-time constraints. At any rate, it should be stressed that designing and running an on-line course means adopting methods and precautions that differ considerably from those in either traditional DE or face-to-face teaching.

At the outset of an on-line course, a face-to-face induction meeting is generally held over one or two days. On this occasion, people get to know
one another, the course is presented, and the methodological approach and technology to be used for distance communication are explained.

The course is divided into stages, each made up of modules. The stages are organised according to a fixed schedule while the timing of modules is usually more flexible to respond better to the participants' needs. Stages and modules are generally based on a series of specific activities; this is sparked off by tutor “prompts” (proposed reading, beginning of a debate, etc.), leading to individual study, and finally an on-line meeting where all participants (students, tutor, experts) examine the subject collectively.

One particularly sensitive aspect of on-line education is evaluation. On-line courses are strongly focused on participant interaction via the written word. This means that all network activities produce output, which may be utilised for evaluation of individual student learning or of the course as a whole.

Evaluation usually comprises both quantitative and qualitative methods: on the one hand, assessment concerns the students’ level of interactivity (frequency of exchanges), and on the other the quality of their general output and their end-of-module and end-of-stage papers; in rare cases, tests may also be set. The end of an on-line course is marked by a feedback session in which both students and tutor have the chance to compare notes and talk matters over, each drawing their own conclusions about the progress made in the course.

Finally, grouping the participants. Generally speaking, there are two possible ways of forming groups, which for simplicity's sake we shall call "network grouping" and "group of groups". In the former case, participants work separately at their place of residence and all exchanges take place via the network. In the latter case, local groups of 3-5 people are formed (learning group) and are given a supervisor and a computer conferencing link with the other participants (other groups, tutor, experts).

It is clear that the criteria for performing group activities and evaluating both individual students and the course itself vary according to which structure is adopted.

In the network group, communication and collaboration take place on one level only, i.e. the network context. Conversely, the group of groups works on two levels, the local context and the network context. In this case only the outcome of group work is available on the network and local exchange remains invisible, while all of the network group's communication can be accessed via the network.

We shall now see how the notions examined thus far have found practical application in MEDEA (Metodologia Didattica per l'Educazione Ambientale), an on-line education course for Environmental Education teachers in Italy.
Our Approach to Environmental Education and Teacher Training

The idea behind MEDEA was to respond to the needs, constraints and structures of EE by adopting on-line education approaches (Briano et al., 1994). The course originated within the framework of LABNET, an R&D project carried out by the Italian Research Council’s Institute for Educational Technology (ITD) under the Environmental Information and Education Programme (INFEA), one of the areas of study included by the Ministry for the Environment in its 1989-91 plan for the protection of the environment. In this section we briefly describe our approach to environmental education.

The existing school structure and traditional curricula appear unsuitable for creating a culture of sustainable development. In particular, the knowledge transfer paradigm typical of the education system cannot adequately achieve the goals of environmental education, which concern the acquisition of attitudes, values, behaviour and cognitive skills. The reason for this shortcoming is that, within the narrow confines of the school environment, these aspects are difficult to fully expound, set out systematically, learn individually and communicate. Furthermore, the knowledge and special skills required in the EE field are developed through interaction with an environment familiar to the student and are not available as formalised textbook knowledge.

To overcome the limits of conventional education, Italian schools are increasingly looking to an alternative educational practice: learning through projects. The development of EE projects involve the participation and co-operation of teachers from different subject areas. The distinctive features of such projects are interdisciplinarity and collaboration between teachers and students.

The development of an EE project at ITD is defined as an approach which embraces methods and tools used in educational technology and takes into account requirements which all EE projects should satisfy: the study of an environmental issue rather than given content, interaction with the local environment, improvement of that environment, increasing general awareness of the problem, interdisciplinarity, co-operative work, systematic exchange of points of view, etc.

The approach involves four phases: pedagogical design, planning, implementation and validation (Midoro & Briano, 1994). Specifically, the methodology indicates how the various activities within each phase should be accomplished.

The first two phases (as well as the last one) are carried out by a project team composed of teachers and, where needed, outsiders such as researchers, experts, etc., who can help organise the project. The initial phases centre on designing the project and planning ensuing activity. Both
during and at the end of each phase, the team exchanges views with the students and negotiates with them. In the third phase, the students carry out the project along with the teachers. The underlying assumption here is that learning arises from the work undertaken by the students to develop a product.

The approach demands that the teachers possess knowledge and use methods which are often alien to their cultural background. They are required to have subject-related knowledge of the area under examination, as well as the ability to formulate and analyse environmental problems, to organise study and process data concerning the issue. Methodologically speaking, the teachers must learn how to conduct the project according to an approach they are not familiar with. MEDEA is aimed at training groups of in-service teachers in the application of the above mentioned methodology.

**MEDEA: an on-line training course in environmental education**

In MEDEA, computer network resources were utilised to support learning activities that involved groups of teachers living in various Italian cities. Rather than dealing with individual teachers, MEDEA addressed groups of teachers, the aim being to encourage local face-to-face interaction as much as possible. These groups met up at local EE centres or in their schools in order to use the necessary network links.

Ten groups of teachers located in various Italian cities were enrolled in the course (see Figure 1).

![Figure 1. Initial composition of the groups enrolled in MEDEA.](image-url)
who had an interest in the project, although they did not participate in the work groups.

The course was organised into three major phases, each composed of a series of modules that ranged in length from two to four weeks (Figure 2).

Considerable emphasis was given to practical work and inter-communication in each module: phases of individual and group work alternated with periods of interaction with other groups and tutors/experts (methods and contents). Figure 3 shows the sequence of activities within the individual modules and the role of participants.

At the outset of the course, the students were given a kit of materials that included articles, videotapes, book chapters, reports, etc. Each module was based on individual study of the material, discussion about the content, activities proposed by the tutor in each local group, communication of results obtained by the local groups to other groups, and inter-group discussion (Figure 3).

Upon completion of MEDEA, the groups were to produce a final product, i.e. their EE project. A final face-to-face meeting was held at the end of the course to discuss the whole experience.
Report on the Conduct of MEDEA

This section takes a fairly detailed look at how the course was conducted so that the reader can get a better idea of some of the key issues in this type of study. One such issue is how the process of collective building of new knowledge (Kaye, 1991) actually takes place. Other factors include the technological and organisation problems that are invariably incurred, how group composition can affect the quality of activities undertaken, and the need for on-going rescheduling of the various activities.

Module 0

The purpose of this module was to familiarise participants with the communication technology used and to introduce the groups involved in MEDEA to one another. Communication in this module largely concerned confirmation that the course material had been received, introduction of the
groups, introduction of the observers and some of the hitches the groups had encountered with their computer network links.

Module 1

Discussion in this module centred on how to go about choosing the environmental issue to be examined in the proposed EE project and also covered selection of the issue itself.

The group from Ovada recognised the need to involve the students in the choice of the environmental issue and as a result drew up a questionnaire to find out what the most urgent problem was. This led to a discussion about student participation in all phases of educational planning.

This module saw the overturning of the original decision to adopt a single environmental issue for all the groups, who instead opted for selecting the problem on an individual basis. It later became clear that this move undermined group interaction. During the module, the role of the tutors was also clarified and there was continued discussion about organisational issues surrounding compliance with the schedule and the structuring of each group’s work.

Module 2

The purpose of this module was twofold: to examine how to define the aims of the study, and to define the goals of an EE project, namely modification of knowledge, behaviour and values. On the one hand, these aspects are clearly related to the chosen environmental problem, but on the other they concern more general issues that are independent of it.

As it turned out, the discussion focused on a number of key questions: how goals are defined and who should be involved in this decision-making process; what kind of goals an EE project should strive to attain; what general aims are common to all EE projects and which are specific to the individual project; how the attainment of goals can be evaluated; how the student’s initial condition can be ascertained with respect to the stated goals; whether these goals are likely to require readjustment during the project.

In the course of this module some of the groups continued to experience difficulties with their network link, while others introduced themselves to the other participants.

Module 3

The purpose of this module was to examine ways to select a particular environment for study within the EE project. The key idea was that understanding of an environmental issue should arise from interaction with
an environment that the students have a close link with, and that they should thus be keenly aware of the problems involved.

Discussion highlighted several fundamental elements in the choice of environment, reflecting the differences in group composition. Groups made up of teachers from the same class were generally able to select an issue fairly effortlessly. The Ovada group came up with a series of preliminary steps: assessing student awareness, interviewing local residents, reviewing local press coverage, and surveying the students about their preferences. The Perugia group, made up of teachers from different schools, did not single out a particular environment but rather focused on the criteria that should be considered by all when choosing an environment: proximity to the school, ease of access, student safety in the field, etc. The group-of-groups composed of teachers with previous experience of an EE project (Padua) opted for the environments they were already studying.

Discussion also looked at the question as to whether it is better to begin with an environmental issue and then choose the environment to be studied on that basis or vice versa.

**Module 4**

The aim here was to represent the specific environment chosen for study. In this phase each group, assisted where necessary by outside experts, was expected to produce a model of that environment, identifying the basic elements that comprised it and the relations between them.

This was a particularly challenging module, given that the teachers were unfamiliar with modelling techniques and that the process itself calls for special skills that they did not possess. We expected the teachers to tackle this task and confront the difficulties involved, while not demanding that they actually master modelling techniques. We touched on formal representation techniques like Petri nets but stressed that learning to use them was not one of the course objectives. Nevertheless, many groups requested study material on this technique and duly set about trying to represent their chosen environment with Petri nets. As it was not possible to send graphics via e-mail, they sent in faxes and asked for feedback on their efforts. Several groups stated that they felt the need for field work in their selected environment and made reports about these studies. At the final meeting many of the groups claimed that this module was the most interesting one in the whole course.

**Module 5**

The purpose of this module was to correlate the contents of the EE project with school curricula.
Communication in Module 5 chiefly concerned the subject areas that each group believed could be dealt with during the project. An interesting observation was made by members of the Trieste group; having initially set out to search through the entire national syllabus for subject matters which may be relevant to the project, they soon realised the enormity of this task and subsequently decided to take the opposite approach, namely to proceed by working through the project and each time a learning need arises seeking to match it with specific topics from the syllabus.

Module 6

The aim of this module was to focus on the need to generate a product from the EE experience and to discuss how to set about choosing and designing that product.

At this point the participants were informed that representatives of each group were to attend an end-of-course meeting in Genoa and that recognition of course participation would depend on each group presenting a final product that summed up their activities. This module coincided with the Easter holidays and in the end overlapped with module 7; some of the groups sent in the results of both modules simultaneously, while others delivered them together with the final product. Not only was there an exchange of ideas with the tutors about possible products and how to involve students in their creation (put forward by the Ovada group), but also there was an interesting discussion about the role the product would play in an EE project.

Module 7

The objective in this module was to examine how to plan group work during the project (choice of activity to be covered in class, definition of a schedule for the experiment, selection of tools and resources, forming of groups, tasks to be assigned to the various groups etc).

Activity in this module was somewhat low-key because the participants were already busy working on the final product. Some groups tackled this module and the preceding one at the same time.

Three groups out of ten delivered their final product, while a fourth sent theirs in a month after the end of the course.

Final Meeting

The course concluded with a final meeting in Genoa open to all participants but attended only by the groups who had finished the course, plus the Perugia group and two observers. During the meeting the participants shared their experiences and took part in a lively debate on the subjects of
on-line education and the methodological approach adopted for the EE projects in the course.

**Results and Considerations**

What results were achieved in MEDEA and what lessons were learned? This section focuses on the following aspects: messages, schedules, groups, educational impact, tasks and further developments.

**Messages**

Three-hundred-and-eighty-three messages were produced during the course. Figure 4 illustrates the proportion of messages by author.

![Figure 4. The proportion of messages by author (n=383).](image)

The significant fact is that 55% of messages were created by the tutors, 41% by the students and 2% by the observers, who contributed comments on course organisation and content.

This means that the tutors “talked” a lot. In on-line courses, tutors are generally seen as mediators who summarise the subjects under examination, clarify them, encourage participants and suggest new topics for discussion. Tutors are also there to indicate what is to be done, the way in which it should be done and according to what schedule, as well as periodically gauging progress made (Feenberg, 1989). For this perspective, therefore, the share of messages generated by the tutors should be much smaller than that of the students.

Nevertheless, only 25% of messages sent by the MEDEA tutors can be interpreted as purely tutoring messages (in the sense described above). The rest are educational messages related to EE methods and contents, the tutors also being experts in the subject matter. In addition, as the course was addressed to groups rather than individual students, most of the debate about content was conducted at local level. Communications travelling through the network primarily concerned the outcome of work carried out
by the local groups. This led to a reduction in inter-group communication and an increase in feedback about accomplished tasks. What’s more, it should be remembered that the groups worked on similar, but not identical tasks, since each had chosen a different environmental issue for the course. There were thus fewer topics for inter-group discussion and the number of messages exchanged with the tutors increased. On the other hand, the decision to focus on just one problem caused a certain degree of rigidity, which displeased some of the groups. So it remains to be determined whether it is best to have all groups working on the same task or on similar but differing tasks.

As to student-generated messages (see Figure 5), 64% dealt with the course content (delivery of documents on activities carried out, proposals for alternative approaches to individual work, requests for clarification of contents and for feedback, comments on messages from other groups, etc.).

Figure 5. Percentage share of the main topics in student messages.

Here are some typical messages regarding the contents:

To make sense, our work must take into consideration the natural conditions of an area, the alterations and processes that have caused, or cause, pollution; it must measure pollution in rivers and various coastal areas and consider all possible variables. At present this seems hard to put into practice, considering that our district has a fairly long stretch of coastline (about 15 km). We are thinking of focusing on a more limited area that has very serious problems, like the Chiavari zone where the Entella River runs. (Chiavari Group, 11 April 1995)

.... we have sought to stress that the choice of the topic should be guided by methodological considerations .... Rather than debating the content, our group has given priority to analysing the way in which the choice is made .... (Ovada Group, 9 January 1995)

Twenty-eight per cent of student messages concerned the way in which the course was organised and managed (timing, organisation of local groups,
notes on the technology used in the course, etc.). For example: “... while the group works on a module, some members begin examining contents and materials in the next module ...” (Ovada Group, 10 February 1995).

Finally, it should be noted that 8% of messages concerned the initial ice-breaking phase in which the various groups met up.

This break-down shows the need for at least three discussion areas in future courses: one about contents, one about course management and a third devoted to socialising.

Timing

The course began in the last week of November 1994 and ended with a face-to-face meeting of all participants in May 1995. Figure 6 shows how long each module actually lasted as compared with the expected duration.

![Figure 6](80mm)

As we can see, not only did the modules last noticeably longer than predicted (grey lines), but also went over the module closing dates reset by the tutors during the course (black lines). As a result, there were periods when messages concerning different modules were being exchanged in the network simultaneously. While this is perfectly natural in such courses, the technology used (e-mail) does not seem to suit this situation. Even though the course modules were already ordered in a sequential fashion, it became clear that student access to electronic messages needed to be more formally structured.
In electronic mail, all messages end up in a single mailbox: personal messages, those regarding the course, various exchanges from other mailing-lists, etc. In these conditions, contributions that were sent in after the deadline fixed for the various module activities got mixed up with messages dealing with the current discussion topic, creating “noise” in overall exchange. Such problems can be solved using computer conferencing systems, where messages are organised by topic on a network server or, in the case of on-line education, are confined to specific course modules.

While the table highlights a clear need for flexibility, it is just as evident that the technology used has the power to fulfil this need. In response to the students’ requests, the MEDEA tutors modified the length of the various modules as the course was in progress and when this measure proved insufficient, they put back the delivery of closing messages to wait for all active groups to conclude the module activities in question.

There is a further consideration to be made about the technology used; when opting for the Internet’s e-mail service, the course designers were aware that they had not chosen the optimal tool for managing the on-line course. However, the choice was dictated by practical considerations: computer conferencing would not have been viable in this case, and activating and handling interest group communication was simple with e-mail, given that it does not entail special hardware or software requirements.

Another problem that arose from the use of e-mail was that this service is not perfectly reliable. Bugs in one of the network nodes that transferred messages between senders and receivers sometimes caused delays of a few days in mail delivery and even the loss of some messages (luckily confined to a handful of cases).

Groups

As the course progressed, group participation gradually abated (see Figure 7). The course was completed by 5 groups out of 10 (50%), of which 3 interacted frequently (30%) and 2 reasonably frequently (20%).

Kaye (1994), noted that a certain number of withdrawals are inevitable in on-line teaching and learning. However, the MEDEA project has peculiar features which might have aggravated this phenomenon. The point here is that MEDEA did not address individual students, but groups whose make up was somewhat mismatched. As a matter of fact, it included groups of teachers working in the same school and groups from different schools who met up in local EE centres. As a consequence, the former were able to log on to the network directly from their workplace while the latter had to visit the local centres. Those who carried out the project at their workplace found it easier to keep in touch and work in tandem, resulting in greater participation. In addition, they all taught the same classes and therefore
were more motivated to design their EE project together, as they saw a practical future application for it. By contrast, the groups who had to rely on the local EE centres found it harder to organise their work. The EE centre operator acted as a group mediator and moderator at the local level, sometimes even becoming a “network postman”.

Irrespective of whether the groups were working in school or in the local EE centres, each group defined its own organisation roles and schedules. For example the Padua group chose to organise its work as follows:

The Padua group met periodically (10 meetings for a total of over 30 hours) to view the material required for each course module and examine the e-mail that had arrived between meetings. Then there was a discussion in which the work done was compared with the tutor’s guidelines and reports from the various groups. Finally, a draft document was drawn up for e-mail delivery, giving a report on the discussion, including questions, points for further study and proposals. As it turned out, although meetings lasted a minimum of three hours, we were never able to get through the lengthy agenda at a single sitting. We only really managed to carry on because there was always a member of the work group who would read material and messages in advance and then make a report to the others. Another member prepared replies to be e-mailed. However the feeling was that we always had too much on our plate. (Chinni, 1995)

The teachers were undoubtedly faced with a heavy workload and this may be one reason for their pulling out. The Legambiente centre in Padua (Chinni,
1995) found MEDEA an interesting opportunity for further study and reflection, although they were already working on a project known as "Lavori in Corso". As Chinni puts it:

Interest in the innovation brought by MEDEA, together with the basic similarity between its EE methodology and that adopted by our centre, have led us to utilise this course as an opportunity for methodological investigation and to compare experiments done by other groups in order to improve the quality of projects currently under way.

However, not all groups supported by EE centres managed to overcome problems related to organisation, time, distance from the workplace or mismatched membership. In particular, it was hard for them to make connections between the approach used in the course and other projects that were already at an advanced stage.

It follows that educational projects like MEDEA should be aimed at a community that is as homogenous as possible. This principle must apply both to the project leaders (tutors, EE centre operators, etc.) and the local learning group (teachers working from their workplace, teachers meeting at an external support centre, etc.). Finally, it should be noted that one cause of withdrawal from the training course was that MEDEA was denied official recognition from the school authorities. Therefore, although most teachers dedicated between 40 and 60 hours to this activity, the time was not recognised as part of the mandatory in-service training scheme for school teachers.

**Educational Impact**

As discussed above, on-line courses can foster participant learning through collective conversation on a given knowledge domain, which is also the subject of individual study. In on-line education, learning is therefore the result of both individual study of materials and conversation/negotiation with course peers and leaders. This includes a number of related activities, like composition of written messages for other participants, reflection on other people's messages, negotiations on controversial matters, and so on. In MEDEA, these activities were complemented with debate within the local groups and co-operative development of a final project. How then is it possible to evaluate the quality of the processes triggered and the results obtained? While future projects will contain specific discussion areas for reflection on the learning processes set in motion, in MEDEA there was no structure for systematic data collection.

Nevertheless, the whole of the course's message collection is still available, constituting a valuable source of information. In addition, there is also a number of other documents: the final report produced by each group, the end-of-course meeting, informal discussions, assessments by observers, participants' opinions, requests for follow-ups sent in from Padua and
Cosenza, material about the autonomous development of a new project at the Ovada centre, and so forth. Some conclusions may well be reached after data analysis and processing.

In terms of learning, MEDEA’s chief aim was to allow teachers to design and carry out EE projects using the proposed methodology. From an analysis of the final output, we can safely state that the groups who completed the course acquired excellent planning skills in EE; they demonstrated awareness of crucial issues, mastery in tackling them in an original and creative fashion, and motivation and willingness in applying the acquired knowledge.

The various messages and the debate held in the final meeting reveal that the teachers had indeed worked in a co-operative manner, a new experience for many of them; they co-operated with their colleagues from different disciplines and had a chance to relate with other groups, breaking the isolation in which they generally operate. The teachers from Trieste, for instance, produced a number of pages in HTML to publicise the project.

As well as a thorough analysis of the available data, the opinions given by the groups and observers can also give an account of the results achieved:

This year’s experience was really exciting; it brought together people from different cultural backgrounds, helped us to rediscover the pleasure of working in groups, encouraged us to listen to different opinions and negotiate an agreement about end-of-module reports; it gave us first-hand experience in group dynamics: in other words, we got a foretaste of what awaits next year’s students and this will make us good leaders. MEDEA must not come to an end! (Trieste, 5 June 1995)

Participants in the meeting on MEDEA were clearly enthusiastic about the project: a useful experience, particularly in the area of network communication, as well as an involving and rewarding one. The four groups still in full operation display a tendency not to work together (they have worked together and will continue to do so, but it is not yet automatic); rather, they work in parallel and rely on their special link with the tutors. Sometimes it is disappointing when an idea or provocative comment meets with no response. Group messages, filtered by discussion, are sometimes “sterile”, which is no good because there must be group (intergroup) awareness, as well as awareness of common participation in a valuable (but also arduous and distressing) experience. (Furio Petrossi, 10 June 1995)

Conclusions

We have seen how certain aspects of on-line education can benefit teacher training in EE subjects. On-line education differs from first and
second-generation DE systems in that participants glean new knowledge from interaction with one another, and this factor offers enormous potential in environmental education. We have presented MEDEA, an on-line teacher training course on a methodological approach to EE projects, and have examined the structure of the course, as well as how it was carried out. Finally, we have discussed the results and the lessons learned; these will form a solid base for the next version of MEDEA, which will adopt different technology and structure.

Correspondence

Renata Briano, Istituto Tecnologie Didattiche, Consiglio Nazionale delle Ricerche, Via De Marini 6, I-16149 Genova, Italy (briano@itd.ge.cnr.it).

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