Open Classrooms in the Digital Age

Cyberschools, e- learning and the scope of (r-)evolution

Dr. Nikitas Kastis, editor
European Distance Education Network

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INTRODUCTION

Nowadays most people agree with the contribution that ICT is offering to improve the quality of education. Education has to keep on at the same level of social changes and the predominance of ICT in all sectors. We educate students in their culture and this culture has every day more relation with the fields of information, audiovisuals and communication.

The Universitat Oberta de Catalunya (UOC) is making an effort from its very beginning to consolidate the best use of technology in teaching and learning. Technology is not the objective, it's only a tool that helps us to bring up education to the emerging needs in society.

But there is still a hard work to do until the use of ICT will find its natural place in education. For this reason, we are very interested in the Open Classroom Initiative of EDEN and we host the 4th Open Classroom Conference in Barcelona. Students, teachers, universities and educational administrators have to work together for the research of the best use of technology in education, particularly at school level.

The use of ICT in education cannot be the result of isolated experiences. The educational community has to think about the consequences of it in a global society and has to guarantee the development of each specific culture. ICT can help us to overcome barriers of space and time without losing our individuality.

The organisers of the 4th Open Classroom Conference, UOC and EDEN, will continue looking for new ways of teaching and learning that contribute to the dissemination of culture and we will be working together with other professionals and institutions around the world that share with us the objective of achieving an educational system that makes the best of ICT.

Barcelona, November 2000

Gabriel Ferraté
Rector de la Universitat Oberta de Catalunya
Chair of the Conference Committee

Dr. Erwin Wagner
President of EDEN
Co-Chair of the Conference Committee

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THE NEW ICT APPLICATIONS, PRODUCTS AND SERVICES

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Dr. A. Aviram & Mrs. O. Comay

The New Approach for ICT and Learning

The following proposed presentation will refer to a wholly new strategic approach to the "merger" between ICT ,education and learning. This new approach has been developed in the last decade in the CFE (Center for Futurism in Education) at Ben Gurion University & ETE (Empowerment through Electronics] LTD) as a consequence of the attempts to understand and overcome the huge difficulties and very limited success characterizing this "merger", difficulties that are much graver than in other areas(industry, entertainment , consumerism) and success that is much more restricted.

It is a balanced and dialectal approach that on the one hand conceives ICT as the epitome of new inevitable and irreversible culture involving new cognitive, emotional, organizational, social and economic structures (rather that a set of neutral tools). On the other hand, it conceives ICT as being double-edged when judged in light of basic desired social and educational values (rather than as the automatic manifestation of "progress" or "advancement").

It thus strives at a:

- Broad integrative *cultural understanding* of ICT based culture (rather than narrow fragmented technological one).
- *Critical evaluation* of the impact of the object of the above understanding on postmodern societies and individuals.
- Formation of stemming *strategies for the channeling* of the inevitable revolution to socially and humanely beneficial directions.

This new strategy has direct bearing on all level of interaction of ICT and education:
From the design or adaptation of new ICT based products, through the procedures of their introduction to schools and to educational systems and their required reconstruction, up to the formation of an holistic systemic program of merger of ICT, education and learning(Aviram, 2000).

Past and future Implementations and Presentations of the New Approach

The new approach has been implemented by the CFE and ETE in several projects, some of them initiated and financed by the EC (Aviram & Bar-On, 1997), (Van Der Velde, 1999), (Aviram & Bar-Lev, 1999).

It was presented systematically for the first time in a seminar initiated by the EC in Jerusalem , July 1999 (Aviram & Richardson, 1999) and then in the National Conference on ICT and Education organized by the Israeli Ministry of Education in Tel Aviv, June 2000- as a foundation for the third computerization program of the Ministry (Aviram,.2000a).

The Structure of the Presentation

The presention will be carried out in the following stages:

1. The theoretical delineation of the new approach, its rational and recommendations stemming from it. This approach is based on the recognition of the fact that traditional and modern aims of education have lost their validity due to the actual acute crisis in leading views and ideologies in postmodern society (Known also as "The End of Ideology" or " The End of History Phenomena").

It is farther Based on the assumption that western democratic postmodern society have to re-think most social and educational aims by returning to the foundations of the humanistic world view which lies at the basic of the social-normative fabric and constitutions.
A search into this foundations reviles that there are three basic humanistic values:

- The development of the Autonomy personality
- The development of dialogical social belonging
- The enhancement of moral values

We in the CFE have taken these values seriously in our work during the last decade and have been engaged in a continuous process of:

Clearly understanding and defining this values.

Reaching an operationalized definitions of these values.

Translating this operational definitions into a large and coherent framework that can and should serve as the starting point for social and educational activity in democratic societies (AOT: Autonomy Oriented Education).

Developing this framework by:

1. Integrating into it elements taken from proven prevailing theories and approaches (Consstructivism Multiple Intelligences, Emotional Intelligence, Learning Styles, The reflective practicioner, Community of Practice).
2. Implementing, testing and improving it in practice.

Deducing from the large framework of the AOE a coherent detailed tutoring methodology (AOT: Autonomy Oriented Tutoring)

Translating the AOT to various environments and sets of guidelines:

1. Guidelines for human tutors
2. Guidelines for the design and implementations in distance learning Internet based environments.
3. Guidelines for the design and development of " independent agents" aimed at the long term empowerment of the learners.
4. Guidelines for the fromation of visions on the macro level concerning desirable educational organizations and systems. ies.

2. The operationalization of the approach in the context of:

- Systemic computerization policies of educational systems (for example: of the Israeli computerization program which is now being restructured according to the new approach[Aviram 2000a]).
- Design of new ICT based products (for example of few EC financed projects now carried out by the CFE in cooperation with ETE Van Der Velde, 1999), (Aviram & Bar-Lev, 1999).).
    - The ICT based restructing of educational organizations and municipalities (as carried out in the last decade by the CFE [Aviram & Bar-On, 1997],).

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INNOVATIONS AND CHANGES IN THE NORWEGIAN SCHOOL EDUCATION SYSTEMS

Morten Søby, Norwegian Network for IT-Research and Competence in Education

Introduction

Many countries are implementing educational objectives aimed toward preparing citizens for the information society. The pervasiveness of ICT is seen as both the genesis and potential facilitator of this goal. In this vision of cyberschools, the increased flow of information is associated with more autonomous learning environments, environments rich with ICT and people htat support pupils/student learning.

Norwegian Network for IT-Research and Competence in Education (ITU) is an academic and administrative unit, which is a part of the Faculty of Education, at the University of Oslo. The establishment of ITU is one of the measures taken by the Ministry of Education in ICT in Norwegian Education 2000-2003, and its forerunner ICT in Norwegian Education 1996-99, to strengthen R&D in the pedagogical use of ICT in education.

The educational target area has been defined in broad terms to include primary, secondary, upper secondary schools and teacher training institutions. The first three-year period (1997 - 1999) has been extended for a four-year period (2000-2003). During this time ITU will act as a network node on a national / international basis.

Through interdisciplinary co-operation and network-building, ITU contributes towards attaining and communicating knowledge about how ICT can be used, the possibilities that ICT gives in the teaching/learning situation and as a means for development for teachers and students as well as surveying the effects of ICT in education.

Research Project Goals

ITU's goals for its research projects are that they should contribute to raise the Norwegian educational system from the traditional, teacher-focused transfer of knowledge, towards more active, participatory, problem-oriented, project-based learning and work. Pedagogically, this points in the direction of a constructivist classroom and collaborative learning. At the same time, this also implies a reorganisation, where schools leaders' development and teacher competencies are central.

ITU's projects aim at optimisation in the use of ICT. ICT must be adapted to the various learning situations, the teacher, context, pupil/student and content. Through its activities, ITU can contribute to the implementation and use of ICT in education, as well as to draw implications of ICT's incorporation in education, where ITU also focuses on multicultural and gender aspects. ITU's development projects are built on the results of research.

Moreover, ITU's research projects should:

- Contribute to a national and international, interdisciplinary and network building research and competence development. Provide information to national and local policy-makers that they can use to make decisions related to ICT and the role it might play in advancing Norway's educational goals and addressing educationalneeds and problems.
- Contribute to synergy-effects between researchers and other aspects of society. Provide teachers and other practitioners with new ideas about how they can use ICT to improve classroom practices.
- Develop a systematic and transferable knowledge. To add to the body of research knowledge and theory about the contexts and factors that contribute to the successful and sustained use of innovative technology-based pedagogical practices.
- Identify and provide rich descriptions for innovative, ICT-based pedagogical practices that are considered valuable by each country and that might be considered for large-scale implementation.

ITU's focus is on primary, secondary, upper secondary schools and teacher education in a wide perspective. Equality is high on the agenda and as such, addresses issues of equity for students of different genders or ethnic groups. Examples of innovative cases are:

Innovative Learning Environments

ITU's own research projects at Nesodden and Sandefjord Upper Secondary Schools. The projects have so far been aimed at the implementation of ICT in learning environments. The research focus is on pedagogical innovation – how pedagogical practice adjusts to today's challenges. The school is seen as an organisation, and as such, the changes that ICT implementation has created within the organisational framework. The project also focuses on how the use of ICT stimulates learning and surveys how different technological artefacts contribute to create a flexible and well-informed learning environment.

WISE – Web-based Integrated Science Environment
Creating a net-based learning environment in the teaching of science. The aim of WISE is to create a database within the field of teaching in science that lays the groundwork for modules and activities. The aim is for teachers to be able to go in and choose from a variety of science topics. WISE topics are either controversial ones, where science does not provide all the answers and where students are encouraged to discuss and to look at different aspects of a topic, or more traditional ones, where WISE technology can be used either as an alternative teaching method or as supplement. These projects are easily adjusted to one's specific needs. Researchers and teachers are working on building up a "library" of WISE topics. Collaboration: University of Oslo, The Norwegian University of Science and Technology and University of California, Berkeley.

EduAction II

EduAction II, as the name implies, emphasises the possibilities of virtual reality and co-operative learning. The project uses three-dimensional multimedia programmes to stimulate active participation and co-operative learning processes. An innovative experiment with virtual reality, where students co-operate in a virtual world – a fantasy planet which is threatened by various environmental catastrophes, where survival lies in active student co-operation. Secondary school students and teachers participate in testing the programmes. Co-ordinator: Norwegian Telecom R&D.

Docta II

Design and use of Collaborative Telelearning Artefacts ≠ Natural Science Studios. The project focuses on the design and use of technological artefacts to support collaborative telelearning. Through participation in scenarios, students gain experience in collaborative telelearning and design of textual and visual artefacts. The research is not limited to only studying these artefacts per se, but includes social, cultural, pedagogical and psychological aspects of the process in which these artefacts are an integral part. The theoretical approach is embedded in a socio-cultural perspective that emphasises an understanding of language, culture and other aspects of the social setting. The methodology is influenced by ethnographic studies. Co-ordinator: University of Bergen.

Pilot

The Ministry of Education, Research and Church Affairs (KUF) established the research project PILOT, on a national basis. It is linked to pedagogical/educational use of ICT in primary, secondary and upper secondary education. ITU is responsible for co-ordinating the research and the researchers' web forum. The main research questions in PILOT are:

Develop and gain experience with learning methods and organisation methods where the use of ICT is integrated, and where the focus is on the student-teacher role.
Establish and develop further small local schools and a decentralised and varied educational system through use of ICT
Develop the school as a resource centre in the local environment through use of ICT
Develop flexible, ICT-based training/courses for children and adults
Expand ICT competence in the educational/pedagogical staff.
Co-ordinator: ITU.

Sites II

SITES II is initiated by IEA (International Association for the Evaluation of Education Achievement). Stanford Research Institute (SRI) leads the research project. The research, which is world-wide, focuses on innovative pedagogical practices that use technology (IPPUT), the change in pedagogical practice and its impact on student learning. Module I, which has recently been concluded, included a quantitative overview in the field of ICT and education. Module II is in its starting phase and will be a qualitative research linked to the classroom-level incorporation of IT into schools. Norway is one of the participating countries. The Norwegian case studies from primary, secondary and upper secondary schools.
Co-ordinator: ITU

Pluto

PLUTO, which stands for Research in Teacher Education Technological-Pedagogical Restructuring, is ITU's teacher education research project. The research is focused on organisational and pedagogical innovations within the institutions, based on the total integration of ICT. After a competitive call for projects, three teacher training institutes were chosen: two teachers' colleges and a postgraduate certificate in education institution participate.

Østfold College

Organisational and pedagogical innovations based on ICT integration
Technology to supply subject-teaching with a new dimension, content and methods
Virtual communication and co-operation arenas to create new and better conditions for practice/theory reflection and development of knowledge. 120 students are provided with laptops and a wireless network.

Stord/ Haugesund College

Change in content, Organisation and Work Methods in Teacher Education
Develop a clear connection between study and practice – testing out a new model for teaching practice.
Contact between student-teachers and schools throughout the school year
Integration of ICT in teaching/learning through new communication technologies, where the aim is to provide the student-teachers with the competencies and necessary skills.

The Institute for Teacher and School Development (ILS) at the University of Oslo

Practical-pedagogical education in a digital learning environment
Develop ICT-based solutions between different partners in education which will contribute to a common learning platform
Develop insight and competence in the student-teachers' use of ICT both as a resource for their own learning and developing as well as for the development of a learning milieu and as a resource at school.
Co-ordinator: ITU.

Innovation

Innovative is a difficult concept to specify and operationalize. The Norwegian innovative examples include practices that promote active and independent learning, provide students/pupils with competencies and ICT skills, engage students/pupils in project based learning and gives the schools access to on-line resources.

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TOWARDS A SCHOOL IN THE INFORMATION SOCIETY

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A school somewhere in Spain, near the end of the mid term. Thursday, recess time. A lorry stops by the front entrance.

- *"We've brought some twenty computers sent by the Consejería de Educación. Where shall we unload them?"*
- *"Leave them under the stairs until we can set up a classroom"*

End of the third term. A classroom has been arranged as a computer lab with a few desks and a few dozen electrical sockets. Besides, the Consejería has promised to install an ISDN so that it is ready for use at the beginning of the next school year.

September, beginning of the school year, a brand new computer lab. The local Teachers and Resources Centre will soon provide a quick introductory course on MS Word and the Internet since the majority of teachers do not feel very confident with computers. Some teachers feel guilty about their computer illiteracy, a few even feel proud of it, the majority do not care much and take a look at the pile of exams they have to mark. A couple of loonies have installed the last version of Dreamweaver. The parents of the students are satisfied. Our school is ready to enter the Information Society. Or is there something missing?

Many teachers have witnessed this scene in their own schools in the past few years. What happened afterwards? Have they taken advantage of their computers before they become obsolete? Have the teachers become computer literate? Have they changed their teaching style? Are the computers loaded with educational programmes? Each school has followed a different path throughout the ICT (Information and Communication Technologies) world, but the experience of the majority of the schools shows that, in spite of the relative speed at which the public authorities have put computers at our disposal, the great leap forward has not occurred yet. What is going on? Would things speed up by buying more computers? In this paper we will take a look at the aspects that currently affect schools in their way towards the Information Society. We will also analyse the changes that should take place.

How do ICT contribute to education?

The educational system cannot afford to stay aside of the revolution that is affecting nearly all facets of our society. Industry, leisure, commerce, the administration, they have all incorporated computers to their way of work and there are increasingly more jobs related to the information society. Computers have slowly introduced themselves in the daily life of ordinary people. The school is not only required to improve the teaching of the contents it has traditionally transmitted, it is also required to update its methodology and contents. ICT will never replace a good teacher, but we cannot afford to ignore them. At least we should be aware of their contribution in order to decide if they are a worthwhile option.

ICT at school can contribute with:

- Methodology: an updated vision of education in line with modern teaching and learning theories.
- A powerful tool for communication available for teachers, students, parents and the school in general.
- New teaching materials that are much more that textbooks packed in a CD-ROM.
- An open and flexible form of education.

But new needs appear for the school and the society:

- Investment in hardware and networks.
- Development and acquisition of educational software.
- Teachers training so that they can make the most of the new technological means.
- More educational research.

Educational materials

It seems obvious that the first task after installing computers in a school is to provide computer literacy for both teachers and students. They should all be capable of using the operating system, a word processor, a data base system, a spreadsheet, and a navigator. But even after that, textbooks and blackboards would still be the main teaching aid.

The educational materials based on ICT should provide an added value as compared to the traditional ones. As a sample list we can mention:

- Simulators (of machines, physical systems, human populations, systems)
- Search engines
- Symbolic manipulation or graphical display of mathematical functions.
- Collection of statistical data
- Word processing
- Problem solving
- Interactive exhibits and demonstrations
- Collaborative group work
- Collection of scientific data from laboratories (sensors, etc.)
- Spreadsheets
- Foreign language learning
- Digital creation of music and other fine arts
- Basic computer programming
- Computer aided design
- Interactive hypertext encyclopaedias

Ideally, these computer-based materials should be adapted to the school curriculum. In this way, we could teach square roots, discuss the characteristics of the Nile, or practice the correct pronunciation of a foreign word in a new a manner. Is this software available in the market? Although the situation keeps improving, just the so called *edutainment* is often found, that is, educational material that seems more suitable for students to do remedial work during their holidays at home than for teaching curricular contents at school. Sometimes we found spare materials that may be used as complementary activities. This material is not usually suitable for collaborative work. The availability of materials varies according to the educational level and area.

Educational publishers feel reluctant to invest large amounts of money to produce very expensive materials (Harvey, 1995) which are easily copied by the users or "adapted" by other companies and that should at the same time be adapted to the various curricula existing in the different regions or countries. On the other hand, these companies would only start mass-producing educational software if they were certain that all schools could comply with the ideal ratio of four or five students per computer. That would also mean that all the classrooms were equipped with computers and that they were available at any time of the day. The computers should also be reasonably modern and powerful in order to support that software.

When acquiring software elaborated by foreign companies, usually from English-speaking countries, it is important to check that they are properly translated to the language of the students. Besides, it is important to notice that the cultural and geographical context may not match our own.

Equipment

A student / computer ratio such as the one mentioned above implies important budget expenditures in order to provide the optimal number of computers to all schools. We should also keep in mind that the cost o buying hardware represents only between 20-25% of the long term investment, since large amounts should be dedicated to administering and maintaining the computers system, not to mention teachers training costs. Thus, we are facing an expensive educational model.

Methodology

Technology applied to education can show all of its potential as a means to facilitate key and qualitative changes in the teaching-learning process. In contrast with the traditional method of education in which facts are transmitted from an active teacher to passive students, constructivists believe that learning takes place by a process in which the students play an active role, building conceptual structures that are the foundation of their knowledge.

With the aid of technology, students can be introduced to new concepts in a more motivating manner, encouraging group activities that facilitate the acquisition of collaborative work techniques often used in other working contexts (Riel, 1990). These group activities may involve students of different ages and learning levels. Thus they have the opportunity to learn from one another in a sort of interaction that is beneficial for all.

In spite of its possible disadvantages, the constructivist model seems to be promising and suits well the use of ICT. But the true value of ICT will be clear after a deep restructuring of education that allows a more individualised type of learning.

Such educational model has the following characteristics (Becker, 1994)

- Greater attention is given to the acquisition of higher-order thinking and problem solving skills, and less emphasis to the assimilation of isolated facts.
- Learning basic skills based on collaboration and not in an isolated manner.
- Information resources available when they are needed.
- Fewer topics are covered but they are exploded in greater depth.
- The student assumes a central role as a builder of his own knowledge and skills, instead of passively absorbing the information provided by the teacher.

The schools that have successfully applied educational technology projects have observed improvement in the following areas:

- Improvement in comprehension, motivation, attitude, critical thinking skills, problem solving, reading and writing, maths.
- Reduction of failure, dropout rate and absenteeism.
- Improvement in job placement rates
- Improvement in participation in collaborative work and group projects.

Most researchers and professionals in the field of educational technology are convinced that information technologies have the potential to improve the efficacy of our current teaching methods and perhaps more importantly, to support fundamental methodological changes that could have important implications for the future generations.

Communication

The available technological communication tools positively influence the methodological changes. Most of these tools, e-mail, news groups, etc., are widely available today. They are useful for the different school actors in different ways:

- **The school itself**
  - Providing general information about the school
  - On-line enrolment
  - Providing distance learning courses
  - Providing updated information about current activities
  - Providing information about the individual progress of students.

- **The teacher:**
  - Web pages with information about his or her subject, activities and exercises, links, suggestions, etc.
  - Link to the teachers' electronic address
  - Creating mail lists to address different groups of students.
  - Flexible communication with the students' parents
  - Flexible communication with the students
  - Contacting other teachers to exchange experiences by means of virtual communities.
  - Searching for information in remote databases to plan his or her lessons
  - Searching for materials and addresses that may be used with the students on-line.
  - Lifelong learning on the web
  - Working collaboratively with other teachers.
  - Automatic correction of tests
  - Buying teaching materials or books on the web

- **Students:**
  - Access to information provided by the school and the teachers
  - Communication with other students for collaborative work
  - Communication with the teacher to ask questions or hand in assignments.
  - Searching for information useful for assignments or to learn more about something previously studied.
  - Distance learning in case of illness or other causes.

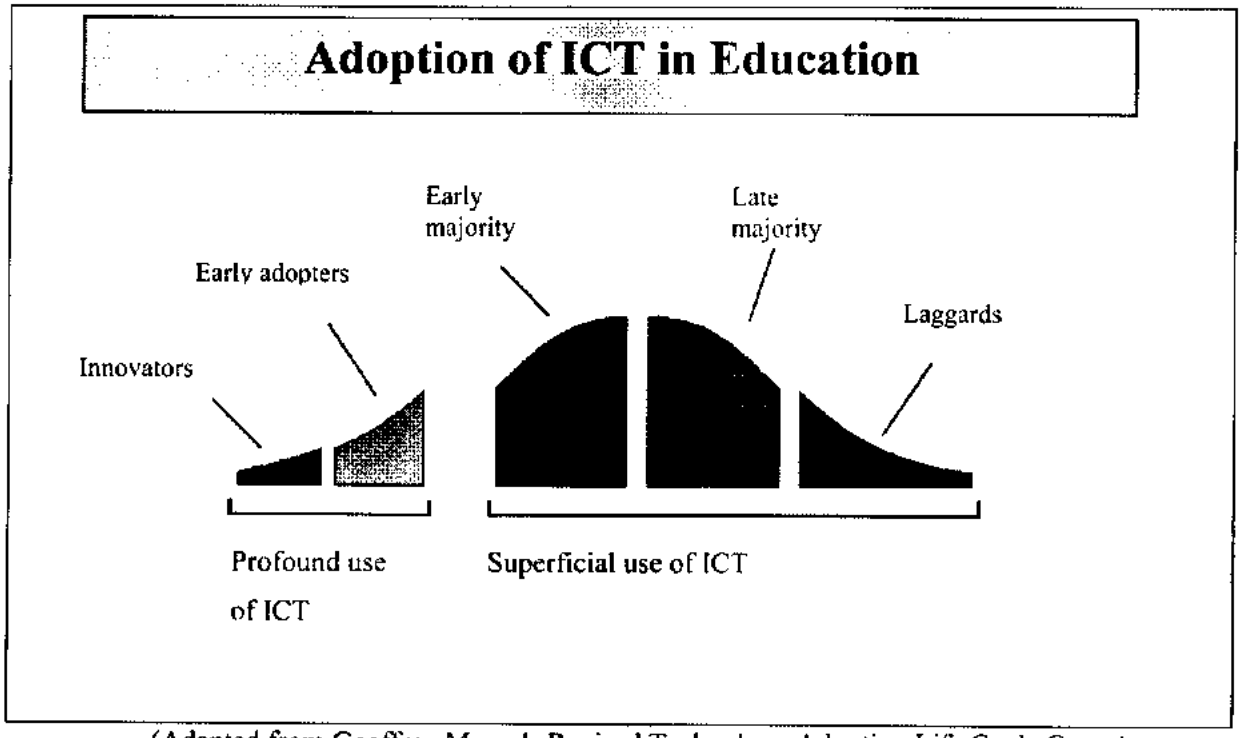
- **Parents**
  - Access to information provided by the school and the teachers in their web pages
  - Communication with the teachers to discuss their child's progress
  - Communication with other parents or parents associations
  - Searching for resources to help their children

Teachers training and their attitude towards ICT

It would be a serious mistake to assume that all teachers feel the same enthusiasm and passion for the use of educational ICT as the innovators. It is necessary to consider the attitudes and needs of the rest of the teaching staff.

Teachers can roughly be divided into two groups: first, there is a group of innovators that is soon followed by a small groupsof early adopters of educational technology. Then, there is the rest of the teachers who, in several stages, adopt ICT and who show different attitudes towards technology applied to education. (Moore, 1996). The first group applies ICT to education with little external support and makes profound usage of the new means.

On the other hand, the second group is reluctant to different extents and makes a superficial use of information technologies. The teachers belonging to the second group do not feel ready to use ICT and should be provided with the opportunity for training. Many of them do not feel that ICT can help them in their jobs. (Dillemans, 1998). There are some teachers, particularly among the older ones, who are reluctant to change the manner in which they have taught for years, especially if it means learning to use a computer. This type of teachers feels unsecure in a computers room and are afraid of losing control of the situation as they are not any more the centre of the educational model. They also feel uncomfortable with students that they suspect are more proficient with computers than they are (Jenkins, 1998). Whatever the case, the school or educational institution must keep in mind that for most teachers, the incorporation of ICT to education, implies an important training and time effort.



(Adapted from Geoffrey Moore's Revised Technology Adoption Life Cycle Curve)

Lack of Sufficient Time

If students are to benefit from ICT applied to education, teachers will have to master the techniques necessary to use such tools. They will also have to adapt their lesson plans to the new means and work out how to share a small number of computers with a large number of students.

Nevertheless, the greatest problem that teachers face is lack of sufficient time in their work day to become familiar with the available software and hardware, to prepare technological activities to use in the classrooms (Sheinhold and Hadley, 1990) and to exchange ideas about ICT applied to education with other teachers. This has an economical implication: how to pay for the additional time that teachers dedicate to training and to design new lesson plans.

Technology in teachers training

Although Education Schools include technological contents in their curricula, the fact is that the training that future teachers receive is scarce and it rarely implies knowledge of the existing software or its practical use with students. This situation may be due to lack of equipment at the colleges, to lack of training of the professors or to lack of time to update their lesson plans.

Improvements in teachers training should consider the use of ICT to improve learning and critical thinking skills. The universities should find ways to encourage their professors to use ICT in their courses. New degrees should be created to include ICT as an educational degree. These new teachers could play an important role at school as computer co-ordinators and to create a critical mass that provokes an educational change. Future teachers should include the use of ICT with real students in their practice period (Barron y Goldman, 1994).

Conclusion

Taking our school to the Information Society implies much more than just installing a computer lab and learning to use a word processor. Important investment is needed on the side of the educational administration on hardware, software, initial and lifelong training as well as in pedagogical research. But a methodology change is also required. This is perhaps the hardest step because it means reconsidering the manner in which teachers have done their job for years. But this does not mean that we are facing a utopic change. To reach the goal it is essential that we take small steps with the means currently available at our schools, that we think about the advantages and limitations of the new means without prejudices, and mainly that we keep in mind the need to improve the quality of education day by day.

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INFORMATICS AS A MANDATORY SUBJECT AT SECONDARY SCHOOLS IN BAVARIA

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The Information Society

During the last few years the rapid development of information technology has caused dramatic changes within our society. The massive digitalization (multimedia) and global linking (internet) of human knowledge are offering gigantic masses of information to every member of our society – as far as he/she has the necessary technical equipment and personal skills to access this reservoir. The retrieval of really valuable information concerning a specific topic and the assessment of its seriousness, authenticity, completeness and reliability are requiring a certain background knowledge about the internal structure of the used networks and the basic mechanisms of information transfer. In order to offer own websites and manage the personal access rights, one has to have basic knowledge about the structure of the World Wide Web. In order to choose the appropriate search engine for a specific task, to interpret the results correctly and to ensure that his/her own site is found by others, one has to know the fundamental working principles of the different search engines.

The progressive miniaturization, efficiency, power and cheapness of microprocessors has led to a broad usage in control systems in a multitude of complex machines from washers to cameras, from cars to aircraft. The possible risks as well as the future chances of these techniques can only be judged by those who are informed about the principal limitations of every form of automatic information processing.

Today nearly all offices and even most of the children's rooms in private homes are equipped with personal computers, which are offering a computing power that was reserved to mainframes some years ago and thus are forming very complex, efficient and productive tools. Their application is reaching from processing of text to communication via the internet, from tax declarations to electronic banking, from videocutting to the production of music-CDs, from "edutainment" programs to fascinating computer games. A competent, responsible and economic application of these machines requires deep knowledge about their inner structure and their working principles. Only the know-how about the features of the file system enables us to manage the mass of our private and professional data. Only the knowledge of the storage size of a video film allows us to estimate, how many and which films can be processed simultaneously. Only the understanding of the working principles of computer viruses prevents us from confusing their real dangers with the numerous rumors about their abilities. Therefore the real mastery of the modern information technology is equivalent with the disposal of a systematic knowledge about the structure, working and construction principles, possibilities and limitations of IT-Systems.

"Informatics" (not exactly synonymous with "Computer Science" in its literal meaning) as the "science of automatic processing of information" offers numerous elements of this knowledge, concerning the representation and processing of information in general as well as the inner structure, the working and construction principles of IT-Systems. These concepts did not lose anything of their actuality and usefulness over decades and many generations of IT-Systems. They are also helpful when it comes to structure complex systems in general, within as well as outside of the field of IT. As an example we could mention the treatment and description of synthetic (formal) languages (e.g. formula of all kinds) or hierarchic structures (e.g. family trees, biologic classifications), the decomposition of complex systems into a set of components (organisation of companies) or the co-ordination of chronological parallel processes (e.g. production or booking processes, collaborations of all kinds).

In addition the science of "Informatics" has developed a precise terminology which allows us to represent and communicate information about IT (and other) systems clearly and understandably (in contrast to the cryptic idioms and acronyms of the "technofreaks").

The Duty of the Schools

At least our secondary schools are forced to react on this evolution in order to fulfil their duty, the general and vocational education of young people, which means the optimal preparation of their students for a life in the information age. The future members of the information society will need efficient, economic and reliable strategies to find digitally represented information within global networks, to interpret and to present them to other people. They will have to solve highly complex problems with the collaborative usage of a variety of IT-Systems (1.).

The mastery of IT-Systems plays the major role in information retrieval as well as in problem solving. Therefore, of course, all students (as well as all teachers) need access to computers and networks and, of course, will have to acquire basic user skills of IT-Systems. But in our opinion this is not sufficient to meet the challenges of the information age, because pure user skills are not transferable from one type of system to another nor from one class of problems to another and therefore will become rapidly obsolete. They are restricted to the user interface and do not allow insights into the system. This leads to an emotional attitude towards IT-Systems. They are loved or hated instead of looked at as what they really are: human artefacts with very limited intelligence and possibilities (2.).

These drawbacks of a pure user skills training (e.g. "computer drivers-license") can be overcome only by imparting certain basic concepts of IT within a mandatory subject (called "Informatics", see 3.), similar to the traditional subject of physics, which offers e.g. basic knowledge about the mechanic and thermodynamic working principles of car engines (without leading the students to a driving license without further training of driving skills) or to the subject of biology, which imparts know-how about the principles of living systems (e.g. animals).

Beyond the mastery of IT-Systems a systematic education in Informatics will generally contribute to the ability of the students to make their living in a highly complex, variedly linked social environment (3.). Information techniques and skills will help them to prepare their tax declarations and judge its results (e.g. algorithms), to understand political processes and connections (e.g. data flows, subsystems), or to manage data and documents of all kinds (hierarchical systems).

Like the knowledge and skills that are imparted within traditional subjects (e.g. mathematics, physics, languages or chemistry), the subject matter of Informatics requires high pedagogical and didactical abilities on the side of the teachers as well as some efforts and devotion on the side of the students. Both of these conditions can only be achieved by implementing Informatics as an independent, mandatory subject which ensures a specific teacher education at university level as well as the equality with other subjects concerning the efforts of the students. Of course the existence of this subject does not bother the use of IT in other subjects in order to improve learning processes.

Informatics as a Subject: Principles

Of course it is not appropriate to teach "Informatics" at secondary schools using adapted scientific curricula from the University. According to our argumentation concerning the duties of our schools (see above) we have to ask ourselves, which informatical skills and concepts will help our students to understand and master IT-Systems, to structure complex systems in general and to navigate in global information spaces (see 4.).

Besides these criteria we have to respect some general restrictions which apply to all subjects. The taught concepts and skills should be valuable and applicable to the students for a long time (which means for decades), should have a broad field of application even outside the area of IT and finally should be teachable in consideration of the age of the students.

Concerning the teaching methods the subject of Informatics is offering, more than any other subject, a very modern and student-oriented learning style: the intensive problem-oriented usage of computers forces teamwork, group-teaching, project work and product-orientation (see 3.).

First Level (Age of 11–13)

During this first period of systematic education in Informatics the students are predominantly working on documents, which are produced and processed using a variety of different standard software packages. While designing graphics and text, managing files using file systems, transporting documents with E-Mail, linking them into hypertext structures and programming simple machines like virtual or real robots (e.g. Karel the Robot, see 5. or LEGO® Mindstorms, see 6.) they thoroughly analyse the used data structures and processes. Thus they are acquiring first insights into basic principles of the digitalization, linking and automatic processing of information.

By analyzing the data structures they detect, that every document consists of specific objects with specific attributes and methods which are typical for the considered type of application. For example the documents of a word processor contain paragraphs with specific margin width or line spacing, which themselves contain characters with specific font type, font size or color. Using this scheme allows the students to understand, describe and compare a variety of phenomenons in the context of IT-Systems.

Of course all these learning processes have to be realized playfully and with emphasis on concrete tasks (e.g. the production of invitations for a birthday party), considering the age of the students. Nevertheless we lay the foundations of a systematic terminology during this period by working as precisely and systematically as possible. This terminology will also be very helpful when it comes to use IT-Systems in order to enhance learning processes in the following years.

Second Level (Age of 14–16)

This stage starts with the extension of the students knowledge about digital representation of information by applying and analysing vector oriented graphic programs and data base systems, e.g. producing, managing and presenting the schedule of a railway station. Afterwards we investigate the principles of automatic processing of information: automatons, algorithms, programs and processes are examined and applied, e.g. by simulating ticket machines, money tellers, traffic control systems or production processes. The next learning step is established by the decomposition of complex systems into a set of simpler subsystems ("divide and conquer") and the examination of the data flows between the subsystems, e.g. investigating flight booking or money transfer systems or en- and decryption of information. Finally the students direct their attention to communication processes between technical objects, which opens deep insights into the working principles of computer networks or cellular phone systems.

All these systems are described and structured by using a specific kind of plan (called "informatic models", see 4.), which play a similar role within the context of IT-Systems as construction-plans outlining walls or installations in the context of architecture. The usage of these plans (e.g. showing data structures, algorithms, subsystems or communication processes) enables the students to describe, understand and communicate exactly every essential feature of the system. While developing and simulating systems according to these plans the students apply a variety of software tools, from flow charters to simple programming environments. In this sense the practical work with the computer forms a major part of the education in Informatics.

Of course the students will discuss also social relevant aspects of the human-computer interaction, e.g. data security, access rights or economic consequences. Nevertheless these topics should be treated as well by other scholarly subjects like Economy or Social Science.

Methodically we make heavy use of large learning projects, which allow the students to detect the multiple linking and applications of the just learned concepts while working on a concrete task and constructing their own products.

Third Level (Age of 17–19)

This level of education is characterized all over Germany by different systems of optional courses. There are no mandatory subjects at this level, except for essential ones like German language, mathematics or English. One of the eligible courses in this context should be Informatics, offering an extension of the basic knowledge that was acquired before by all students.

As a foundation of all following concepts we start by investigating recursive data structures like lists or trees, which are of great importance not only within the context of Informatics. As follow-up we work with formal languages and grammars, constructing and simulating accepting automatons, e.g. describing and testing E-mail adresses or Uniform Resource Locators (URLs). The next step is formed by examining mechanisms to synchronize parallel processes which operate on common resources by simulating e.g. booking systems, money transfer processes or collaborations on common documents. Finally we direct our attention to the principal and technical limitations of automatic information processing, caused by noncomputability or high computing complexity of some problems.

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THE BULGARIAN NATIONAL EDUCATIONAL STRATEGY FOR INFORMATION AND COMMUNICATION TECHNOLOGIES AND ITS IMPLICATION FOR SCHOOL LEVEL EDUCATION

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Introduction

The development of the National Educational Strategy for Information and Communication Technologies (ICT) was assigned by the Minister of Education and Science (MES), developed by a working group, headed by A. Eskenazi and P.Assenova, coordinated by the National Institute of Education, and approved by the Board of MES in July 1998. The implementation of the Strategy is included in the Program of the Bulgarian Government for the period 2001 - 2005 and its main ideas lie in the National Strategy for Information Society Development in Republic of Bulgaria adopted in December 1999.

This presentation emphasizes the basic elements of the National Educational Strategy for ICT.

1. Corner-stones for the Strategy design

The main ideas of the Educational Strategy are developed on the base of following principles and goals.

1.1. Principles:

- Contemporary education on ICT - an opportunity for all;
- Integration of ICT in the complete educational activity and culture;
- Leading role of the individual in the technological changes;
- Life-long learning.

1.2. The main goals of ICT education and their use in school practice are considered hereafter in three main contexts as follows:

The **personality-social context** reflects the opinion that all students should acquire general knowledge and good skills for using computers and nets technologies as necessary basic tools for living and working in a modern dynamic society. The following aspects are considered in details: information literacy; intellectual development; skills, abilities and capacity for independent life-long learning; personal development.

The **professional context** relates to the students' ability to use computers and information technologies in their future work or professional carrier. As a result of the vocational orientation and education students should acquire a determined number of skills and qualities. This context also includes the preparation of competitive specialists for the information industry with secondary education.

The **pedagogical context** of ICT usage is aiming at the improvement of the education quality. It is based on the new possibilities of the ICT environment to hold out more effective technologies and means for teaching and learning, for diagnosis and assessment of the educational results, for collecting, handing, storage and transfer of the information.

2. The levels of ICT education are presented on Figure 1:

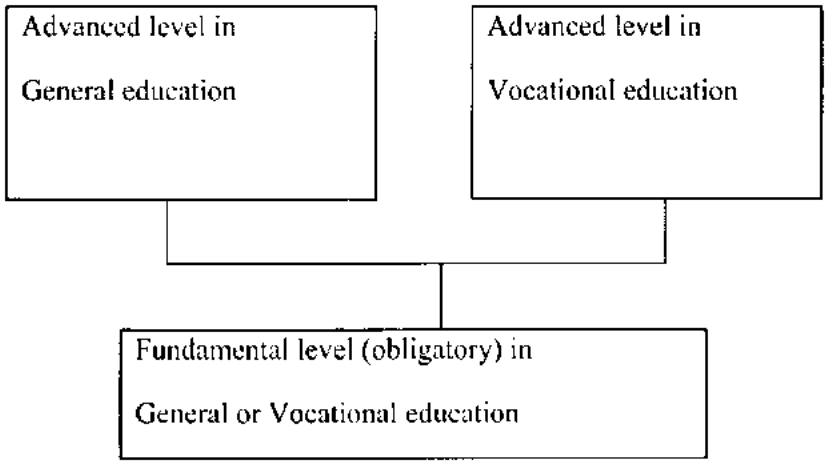

Figure 1. Levels of ICT education

The fundamental level is compulsory for every one as a part of the general or vocational education. The fundamental level gives the **minimum** of knowledge and skills that every student completing secondary school should have acquired. Having in mind the present situation that:

- the computer equipment is localised dominantly in upper secondary schools and in the close future it is not realistic to expect that all Bulgarian schools, including elementary or junior secondary ones, would be equipped with computers and nets;
- the teachers on ICT are concentrated mainly in the upper secondary schools and it is not possible to organise training for all teachers from lower educational structures

it is quite natural to place the fundamental part of ICT education today and in the close future in 9th-10th grade or, respectively, in the first two years of education in vocational schools. Computer equipment and teacher education represent very heavy problems and their solving would allow the age level to be lowered to 6th-7th grade or even to 5th-6th grade.

The integration of ICT in education begins from the first and continues to the last grade. Computer use by children in primary grades (didactical games, simple word processors, drawing editors, etc.) would provide a basis for further use of modern information technologies. The integration of ICT in other school subjects has to be expanded and in long-term - to become a part of the fundamental level.

The advanced level on ICT is possible for both general and vocational education. In the framework of the **general education** it is elective and is built on what is learned in the fundamental level. It can be organized through separated or integrated forms of education and depends on student's interest. For certain general education profiles, for example, for ICT specialists with secondary education, a part of the elective topics on ICT can become compulsory ones.

The advanced level on ICT in the framework of **vocational education** depends on the professional area selected by the students and is based on the fundamental level. This level offers special ICT applications. Two approaches are possible here - separate modules or integration in some vocational subjects. For certain professional areas teaching and using ICT is compulsory. This is determined by the curriculum for the respective profession or is a decision on a school level.

The place of ICT in the school curriculum is shown on Figure 2.

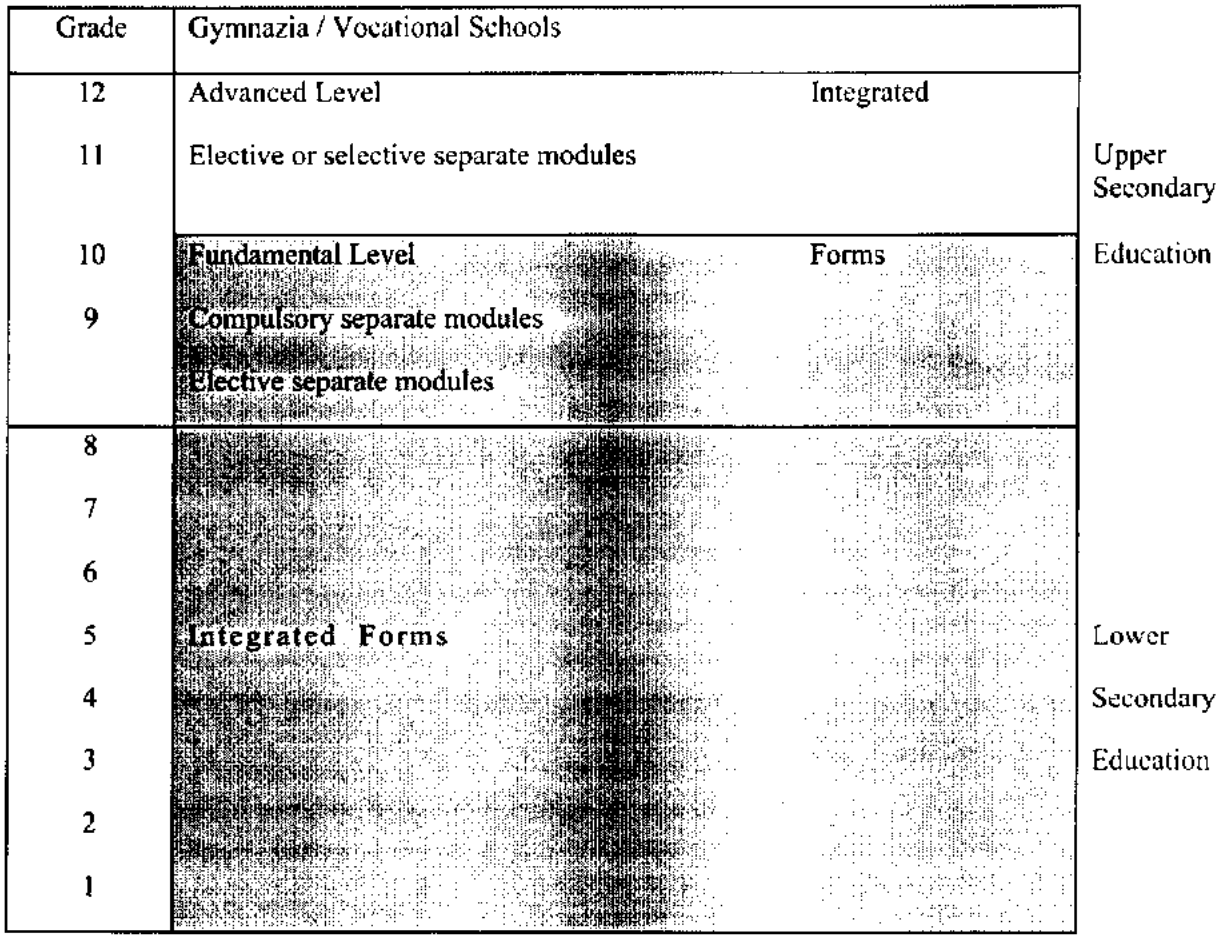

Figure 2. Place of ICT in the secondary school curriculum

The compulsory ICT education is guaranteed by the state educational standards Optional (elective or selective) forms are intended to satisfy specific students' needs. They are connected with the future job selected or with additional interest to ICT.

As a result of the ICT educational system proposed, three type of specialists with secondary school education are distinguished:

- **users of basic ICT**. These are all students completing secondary school;
- **users of ICT in various professions**. These are students completing vocational secondary schools.
- **specialists for the information industry.** These are students completing vocational schools with professional area on ICT or students completing general secondary school with ICT profile.

3. The basic topics of the ICT curriculum are presented below.

3.1. Fundamental Level

F1. Introduction to ICT;
F2. Operating environments;
F3. Computer-aided word processing;
F4. Data bases;
F5. Spreadsheets;

F6. Graphics computer environments;

F7. Social, ethical and legal aspects of ICT use;

F8. Selection of Software tools.

The fundamental topics are obliged. Each of them could be taught deeply trough optional form.

3.2. Advanced Level

A1. Programming;

A2. Programming and software development;

A3. Typing skills;

A4. Advanced word processing (desktop publishing);

A5. Work in a local network;

A6. Global Net. Work with Internet;

A7. Web documents design;

A8. Computer graphics;

A9. CAD applications;

A10. Organization and public presentation of information;

A11. Multimedia;

A12. Computer modelling and simulation;

A13. Expert systems;

A14. Robots and feed-back devices;

A15. Computer music;

A16. Computer-aided processing of statistical data;

A17. ICT in the library;

A18. Computer architecture;

A19. Dedicated applications.

3.3. There are some peculiarities in the curriculum aspect. In future, together with the improvement of the equipment and teachers education, some of the advanced topics should be placed in the fundamental level. Such topics are:

A5. Work in local networks;

A6. Global nets. Work with Internet;

A10. Organization and public presentation of information;

A11. Multimedia;

A17. ICT in the library.

The education is organised on module principles that gives the possibilities for flexibility of education and has respect for students' interests and willingness. The combination of certain modules could give a professional orientation or even a profile. One example only is presented below:

The combination of the modules:

F3. Computer-aided word processing;

F6. Graphics computer environments;

A4. Advanced word processing (Desktop publishing)

would be recommended to those who would be interested in publishing or advertisement.

The ICT modules studied by the student should be stated in the certificate for education completion (the diploma). This will make clearer the individual skills and competencies in this area and will enrich the possibilities for finding a job.

ICT education in vocational schools should be oriented according to the following **professional spheres**:

- Industrial-technical sphere;
- Economic, trade, administrative or service sphere;
- Agricultural sphere.

Certain compositions for each sphere are recommended in the Strategy. Which topics are compulsory - this will be determined trough the curriculum frame adopted for each professional area by the Ministry of Education. Other ICT topics could be added to the curriculum at school level.

4. There are several important reasons for the integration of ICT in other school subjects:

- Students will acquire new technologies solving problems for educational needs.
- They will be brought up to use them in everyday life.
- The high-technology environment for the education in different school subjects will increase the entire effectiveness and students' achievements.

The problem with ICT integration in other subjects is very heavy and is expected to be solved in a long term. The main reasons are following:

- All educational structures have to be equipped with computers and Internet access;
- All teachers have to be prepared to use new ICT in their subjects;
- The Bulgarian experience in ICT education is not very rich.

The main functions of ICT in another subjects are described and some strategies for teachers are proposed.

5. The successful results of our most **talented students** from schools and universities in competitions, Olympiads and software development demonstrate the possibilities of training specialists with different qualification for the computer industry needs. The work with gifted students is the most natural way new ideas for teaching informatics in secondary school to be tested, and to be determined to what extent the students of a certain age are able (objectively or as a level of achievement) to perceive school material with certain complexity. In this sense the basic purpose of training gifted students is to put the top of an „educational pyramid" with sufficiently comprehensive base in the area of computer information technologies.

The organization of gifted students' education is based on the previous educational experience obtained trough school activities or individual ones. Therefore the following forms should be provided:

- Elective/selective class forms;
- Forms for students' participation in the developing activities;
- Programming competitions and Olympiads;
- National competition for students developing software applications.

The education of talented students willing to deal with ICT combines the efforts of schools, universities and highly qualified specialists from the industry in this area. Special attention is devoted to teachers who educate students with higher interest.

6. Equipment and providing access for schools to Internet

The investigations made about the equipment in Bulgarian schools show a picture of strong insufficiency of modern computer and communication equipment. These conditions, combined with the quite limited possibilities of the national budget, make it necessary unconventional ways to be found for solving the three basic questions requiring considerable financial resources:

- Providing appropriate equipment;
- Providing regular and reliable service and supply with consumables;
- Obtaining a license for the minimum of the necessary software products.

The strategy proposes an appropriate procedure based on competition and satisfying the above requirements. It basically involves MES, but also the municipalities and the schools themselves.

One of the basic principles of the IS strategy which is to be developed in Bulgaria is the **opportunity for everyone** to have an access to the new information and communication services. In the framework of the new conception for universal service at community level the educational institutions should be considered as a special group of users. It is necessary skills for work with Internet to be developed from earliest age by **providing permanent access for all schools to the network**. Therefore a national school net is to be developed through which all schools would have access to Internet. Possible financial resources are proposed in the Strategy.

7. At present we do not have a sufficient number of **well-educated teachers on ICT**. It is necessary to educate the following groups of pedagogic specialists: teachers and co-ordinators of ICT, teachers in other school subjects, the school administration.

The following levels of education are proposed:

- Pre-service education - implemented on the university level (Bachelor or Master degrees).
- In-service education. The purpose of the continuous education is to maintain and to raise educational staff qualification: teachers on Informatics/ICT, teachers on other subjects, administration (principals, inspectors and other managers). It is implemented at two levels: supporting (refreshment and improvement of professional knowledge and skills) and qualification raising (acquirement of new professional competencies). The main topics of education are: ICT modules; modern approaches for curriculum development; active methods for education using ICT; ICT integration in different school subjects; design, organisation and management of the educational processes. The system for continuous teachers' education is a diversity of forms of education, activities and practices in which the teachers are engaged in order to widen their knowledge, to improve their skills and to assess and improve their professional approach. It is implemented on the following levels: school, regional, institutional (universities, Institutes for Teacher education), non-institutional (conferences, seminars, etc.).

Therefore the basic **principles** of the system should be:

- voluntary participation in the continuous education;
- flexibility of the forms and topics of education with predominantly development of the educational forms without quitting their jobs;
- free selection of the form and topics of education as well as of the instructing group;
- credit system of education;
- division between the education and certification: the education is implemented by various units (universities, institutes for teacher education, other organizations) but a certificate for reaching a certain degree is given by an expert body;

- the educating units which are willing to train teachers should apply for accreditation (submitting also a conception for education, curriculum, other materials, etc.) by an expert body;
- competition in relation with the centralized financing for the groups providing the instruction;
- binding the qualification results to the statute and payment of the teacher.

Based on these principles, the Strategy considers educational topics, forms of instruction, organization, management and financing of teachers' education, assessment of teacher education.

8. A special part of the Strategy relates to the management and financing.

The management combines centralised and decentralised approaches in the following aspects:

- pedagogical, organizational, and economic problems of the management;
- the levels of management (national, regional, school);
- possible sources of funding;
- the interaction between educational structures and business environments;
- the normative provision of ICT integration in the secondary schools.

The approaches proposed encourage the initiative of the schools and local authorities to develop their own policy for raising the role of ICT in schools.

The Strategy is terminated with a **6 years Program** for its implementation. The Government Program 2001-2005 plans to provide 63 millions Euro for all stages of the Strategy.

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A TUTOR'S ROLE, MORE THAN COUNSELLING?

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Introduction

The teacher's role in distance education is sometimes described as counselling. The teacher is a mentor, whose obligation is to keep the students on track. Sometimes the teacher is described as a facilitator to students' learning. The students are the learners who have to construct their own knowledge at their own pace. These pictures may harmonise with theories of constructivism, with methods like problem-based learning or with a course model where the course material is pre-produced and the progress line is defined.

Different information and communication channels may, however, be used in different ways in various teaching situations. The teaching aim may differ; subjects like drama activities or mathematics cannot use technical means of communication in the same way and the ICT part in the design of a course varies. The teacher's role is still to foster students' or pupils' learning. To avoid a theoretical discussion about the teacher role concept I often use the word "obligation" or "task". A course develops as a dynamic process between the aim of the teaching, the subject, the available subject resources, the model for the course and the obligations of and communication between teachers and students. In a distance course the communication is dependant of the availability and use of technical communication facilities.

I want here to present the experiences and evaluations in a concrete course model where FirstClass (referred to below as FC) was used as the communication programme between 6 groups of teacher students (tot. 30 students) in four countries. The model was used in two courses by the same teachers, but with different students and different themes. In this connection it was conducted with Nordic students, but it might just as well have involved teacher students or school pupils from anywhere in Europe. The experience of being a teacher in the course is of special interest.

Presentation of the model

Participants	Aim	Preparation 2 months	1.meeting 2-3 days	FC comm./3 months	2.meeting 2-3 days	Result
5 inter-Nordic groups á 6 stud.	a) The cross-cultural aspect of the theme b) First Class ex-Perience	Nation.groups chosen a) FC course b) Present some national aspects of the theme	Inter-Nordic groups chose their a) aspect of own group work b) Progress and work plan	a) Group work, following own plan Weekly contact via FC b) Writing log for the group and work process every second week	a) Finishing the work b) Mutual presentation of the result. c) discuss. evaluation	2 reports from each group When accepted documenta-tion of a 6 ects' course
1 tutor to each group + 1 co-ordinator		Teach.group Decide the frame of the course *the aim and theme *the model *the claim of the students	a)Organising b)Introduce diff. aspects c) Accept the students' choice c) Social and cultural event.	Counselling and support	Organising the meeting. Social event	Evaluation of the process and the reports.

These points are further described in the following paragraphs.

The course

The participants:

The organisers (tutors): One teacher from each of five institutions from four Nordic countries, Finland, Norway, Sweden and Denmark (2). In addition a co-ordinating teacher from Sweden.

The students: 6 students from each institution representing pre-school teacher education, primary and secondary teacher education.

The aim

This course was not based on materials that had been prepared in advance. The aim was two-fold:

(a) To give students a possibility to develop comparative approach of teaching questionsin a Nordic perspective

(b) To get experience with FC as communication means in a distance course

Preparatory work

The teachers:
Representatives from the institutions met to agree on general guidelines for the course, that is:

1. How many students should participate from each country?
2. The "umbrella" theme of the course with possible literature list.
3. The structure of the course, that is:
   - how to group the students.
   - the frames of students' participation, the level of work, reports etc.
   - how to counsel the groups
4. Setting up the FC files for a) students in one institution, b) for the inter-Nordic groups, c) files for the teachers d) files for all participants and providing for café and chat functions.

Clarification of the theme and the frame took time. The same teacher group taught the first and the second course. Even the second time round, the teachers were still in some doubt as to whether the theme of the course was too broad and too ambitious.

The students:
The students were given a short course in using First Class. They had to prepare a presentation of themselves and the school system of the country for fellow students in the inter-Nordic groups. The intention was to make them conscious of their own identity and to start the process of getting to know each other. The preparation was the start of the course.

The students were quite satisfied with the information and introduction before they met. They soon familiarised themselves with the FC communication system.

An introductory meeting

The frame of the course was presented at a 2-3 day meeting in a Youth Hostel.

The different national groups introduced themselves and presented their preparatory work at the meeting. The cultural/social presentations from the Nordic groups enhanced the process of learning to understand each other. The meeting offered an opportunity to test the FC communication programme.

The inter-Nordic groups were established, they discussed and chose their aspect or problem question of the theme, chose a student co-ordinator and made a progress plan for their work. The tutor joined in the discussion of the theme aspect. Each teacher acted as a tutor to one inter-Nordic group.

The difference between the initial meeting in the first course and that in the second, was that the national groups were given more time to present the national aspect of the "umbrella" theme to the colleague foreign students. They also got more time to the planning in the new inter-Nordic groups. This turned out to be important. The first time, the teachers thought it necessary to present different aspects of the "umbrella" theme more broadly.

The FC communication period

The students had a 3 - 4 months period of FC communication in the inter-Nordic group.

Access to computers with the FC courseware differed in the different countries. One institution supported every participant with a personal computer; another could give the group shared access to computers on working days only.
Some national groups met during this period to exchange experiences.

FC gave the students access to electronic mail, computer conferencing, "real-time" chat, the opportunity to attach and send documents and to co-operate on the same document. It was up to the students to use these possibilities, but the curriculum required them to join in the work weekly.

The students had to submit two reports, one for the chosen aspect of the theme and one for the process. Each group had to write a log about the progress every second week. The reports had to be presented in a file that could be read by all students one week before the final meeting.

Some of the groups followed their own work schedule without problems. Others, with ordinary group problems, had to revise it because

- they had not taken into account the different students' work load or practice periods during the period.
- there were certain personal problems within the group.
- a Christmas Holiday interrupted the concentration they had when leaving each other in November.

The use of FC possibilities showed that

- the students could use the communication system quite well provided that the equipment was reliable.
- the "café" file was often used for social conversation.
- the "chat" facility was used regularly. One group made it a part of the thematic discussion, another discussed the structure of their work. The content of the chat could be copied into another file for students who could not participate at the planned time.
- collaboration on the same document with comments to each other was difficult. Typical discussions centred on how to understand theories and concepts, how to give their work a coherent structure, what to expect from each other etc. They tended to be more concerned with understanding and sharing the work than with comparing their approaches. Ensuring coherence in the work has proved to be strenuous and demanding.
- activity was more intense in the last than in the middle period.
- students with language problems were satisfied with the written communication. It gave them time to understand and formulate their views.
- the students appreciated the tutoring. In some cases they wanted more help and were insecure about what they could expect.
- the use of logs to document and discipline the work process seemed to be a good idea, but the groups did not all understand the intended function.

The communication system facilitated pedagogical, cultural and personal discussions over time. The "classroom" of files, which is closed to others, gave a feeling of privacy. How the groups utilised the possibilities varied. Even "chat" could open for thematic discussions if the members of the group agreed, and were sufficiently well disciplined to keep their own plans. It made it possible to conduct simultaneous work sessions. Distance work is open to misunderstandings, the FC communication showed how important and useful clarifications are.

A final meeting

The last meeting was planned to give the reports a final polishing, to present the results and allow evaluative discussions between the groups and with the teachers. Minor social and cultural events were included.

The last meeting can be characterised in few words: hard, concentrated, group work, reflections and evaluations about both process and theme, self-evaluations included. The students willingly used the days for discussions from early morning to late night.

The students were satisfied with the international aspect of the course. They appreciated the combination of meetings and FC communication. The widening of the theme in the mutual presentations and reports gave a broader professional perspective. They were especially satisfied with comments from the tutors. The evaluations were both self-critical and positive. They wanted to have the FC possibility open for some time. Afterwards they commented that all students ought to have the opportunity to take distance, international courses.

The teachers' evaluation pointed at the necessity of good planning, realistic ambitions and clear tutoring. It is possible to combine the distance communication period with telephone or video-conferencing. It is necessary to allow plenty of time for developing mutual understanding and thereby make it possible for discussions to take a comparative approach. Perhaps the process for the students is more important than the outcomes. The latter may be viewed as part of the process insofar as they provide evidence of the levels attained.

Some of the tutor's obligations

The management perspective

It was agreed that the course framework had to be clear to the students and that the information given beforehand in each country had to be strictly identical. Pedagogical and economic aspects had to be taken into account, the cross-cultural and theoretical intentions had to be taken care of and the anticipated workload for the students had to be realistic.

Most of the planning was completed at a personal meeting. A mutual agreement was reached concerning structure, intentions and possibilities. However, some uncertainties remained to be cleared up after the participants had returned to their respective countries. Telephonic and FC discussions were needed to clarify interpretation of some points and to finalise some of the agreements.

The teachers represented teacher educations for different levels, but were fairly well acquainted with the school systems in the countries concerned. Reaching agreement about the specification of the theme and possible cross-cultural aspects of the project was no easy matter, despite the fact that discussions were conducted in a cordial and friendly atmosphere. This process was, indeed, as strenuous as it was interesting.

The necessity of being a group partner, a pedagogical planner and scientific teacher became evident. The teachers' group work with the course construction gave important insights into corresponding processes in the student groups.

The information perspective

The same information about the course was presented and clarified on several occasions:

1. in the national groups, before the students had formed clear expectations concerning the actual work ahead. The students were motivated, interested and excited at the thought of meeting students from other countries.
2. by one of the tutors, at the introductory meeting for the whole group.
3. in the inter-Nordic groups when questions about details arose, for example concerning the reports students were expected to submit.

The same information given in different settings and by different persons may give rise to different interpretations by students sitting at their desks in their respective school. For example, the students asked many questions about the report they were required to submit.

This shows perhaps how important it is to reach prior agreement about the framework of the course, the intentions of those conducting it and the amount of work that is expected of the students. Precise information about the scope of the course is of paramount importance.

The mentoring perspective

This is a well-known part of a tutor's obligation. Weekly discussions and reports of the process every second week were expected from the students. The student groups were responsible and had presented their own progress plan for the work. Perhaps both students and teachers had underestimated the discipline needed to pursue the distance course for the whole group while following regular studies on campus. The role of the group leader would, to some extent determine the individual group's need for encouragement and contact. Even experienced teachers were sometimes uncertain about when to let the process go ahead and when to apply some pressure to maintain momentum.

The scientific perspective

The most difficult part of the tutor's task was to intervene in the progress of the common study work with the chosen theme aspect. We expected a theoretical distance communication discussion between teacher students from different countries with some language differences. Furthermore we expected the discussions to be presented in a common report. The easy and necessary part of the support was to help the students structure the work that was assigned to all of them. The more difficult part was to ensure progress in their comparative discussions, to go beyond mere exchanges of information about local conditions and to compare the beliefs and ideologies underlying different countries' guideline curricula or school systems.

One reason for this difficulty was the teachers' concern not to dominate the processes. The dividing line between support and domination is always a fine one. Another reason was that the teachers might have preferred to structure the work differently, but hoped that the students might come up with novel answers or perspectives. The students were expected to develop their own knowledge.

When evaluating the project, the students expressed the need to be in touch with teachers as scientific authorities during the process.

Conclusion

A course model will not guarantee a successful outcome. Good design has to match the aims and subject of the course, the means of communication available, the students and the necessary confines of the institution. Many details of a course are unpredictable, but the quality of outcomes will reflect that of the planning undertaken. Bad planning, unclear information, technical problems and an excessively heavy workload will undermine the learning process. What is most important, however, is the dynamism in the course, the communication between teacher and students or pupils. Jenny Leach (1996) describes different aspects of teacher's obligation and support. She says:

> *" Teacher education, in whatever context it takes place, needs to be rooted in a theory of learning as social practice. The pattern of relationships evolved to support "distance" professional programmes will therefore be critical".*

Furthermore she discusses the interactivity between the teacher and the students and refers to Bruner (1986) who describes this as a negotiation of shared meaning:

> *"The language of education, if it is to be an invitation to reflection and culture setting, cannot be the so-called uncontaminated language of fact and objectivity. It must express stance and counter-stance and, in the process, leave place for reflection, for metacognition."*

And she concludes:

> *This theory critically extends the role of "teacher" or more experienced peer in the learning process well beyond that of mere "facilitator".*

This is bourn out by the teachers' experiences in the course described here. The course was well planned, the information relatively clear, the process was supported, the inter-Nordic groups gave an arena for discussions and reflection and the students were generally satisfied. The processes in the groups were, in the teachers' eyes, more characterised by cooperation than collaboration. The final meeting, face to face, gave room for more collaborative reflection concerning comparative questions.

Perhaps this part would have been strengthened earlier in the process if the teachers had *"extended their role of "teacher" --- "well beyond that of mere "facilitator""* and supported the theoretical aspects of the course work as well. Partners in distance group work need a lot of time to become acquainted with each other. The teachers' expectations regarding the comparison in this course may have been somewhat over-ambitious? The fascination of teaching, whether at school or in university, is that we can never be certain of having found the right answers. The truth may be found in the dynamism between these factors.

Leach has observed (ibid) that learning is social practice. A teacher is responsible for learning situations where dialogues between students and students and teachers are important. Dialogues have social, intellectual and language components, including the resources the participants bring to the process. It seems therefore necessary to include more nuances when describing teachers' obligations in distance as well as campus teaching. The teachers' knowledge has to be part of the dialogue process.

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Recommendations

Planning a course one has to know that the challenge is to take into account what technology, what roles of learning and what kind of work correspond with the kind of knowledge the learner is expected to attain.

The possibilities of the FC communication or another conference system are many. It can be combined with the use of other simultaneous communication channels like videoconferencing or telephone conferences. The recommendations are a list of points that are important for planning. These include the distance aspect, communication possibilities and general aspects to take in account when planning a course.

What is the aim?

- Is the conference a part of a course, or is it "the entire course"?
- Is the process important?
- What kind of product is expected?
- Is a format or informal evaluation included?

Who are the participants?

- Are the participants young students or mature adult people?
- Have they met previously?
- Have they been they formed into groups or are they participating as individuals?
- How are they introduced to each other?

The plan

- Who has chosen the subject for the conference, the teacher or the students?
- Who has made the progress plan?
- Who has made the communication "rules" for the participants?
- What is the time aspect?
- Is FC discussions a part of a course? If so, which?

The tutor's obligations

- Which obligations has the tutor
  - for the group process?
  - for the progress in the scientific discussions?
  - for the function of the technique?
- Is there more than one tutor? If so, have they met?
- Do the students know what they can expect from the tutor?

The tools

- Are the students/tutors acquainted with the communication tools?
- Do they have sufficient opportunities for communication?

Evaluation

- Which kind and aspects of evaluation are the most interesting
  - evaluations from whom compared to the aim?
  - a process or a product?
  - students' experiences?
  - teachers' reflections?

STUDENTS' USE OF INSTRUCTIONAL MANAGEMENT SYSTEM (IMS) SOFTWARE IN IRISH SECOND-LEVEL SCHOOLS

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Introduction

During the 1990s there has been a resurgence of interest in computers in education, driven by the new capabilities for accessing information via the Internet and its related applications such as email and the World Wide Web (Wyld & Eklund, 1997; Watson, 1996). The growth of the Web has been accompanied by the development of a range of tools that facilitate the delivery of instructional materials via the Web. Instructional Management System (IMS) software has been developed to facilitate the management of instruction and communication between students and teachers involved in Web-based teaching and learning. TopClass is one example of such a system. Whilst numerous third-level colleges and universities have used this system to deliver courses using the Web (Blackhurst & Hales, 1997; Freeman, 1997; Kiser & Toreki, 1997; Foley & Schuck, 1998), its potential has not yet been explored in a second-level setting. This paper aims to redress this balance somewhat by examining the effects, from a student perspective, of using TopClass to deliver two separate units of instruction to second year (approximately fourteen year old) students in two Irish schools. Students' use of the system was monitored over the course of the study and this paper aims to explore the factors that impacted on the frequency and regularity of their use. In accessing the feasibility of using this innovation in the classroom setting, some of the concerns are related to logistics, such as the efficiency and reliability of the system. Other concerns are related to instructional content, such as the type of content that is appropriate for delivery via this medium and the layout that should be used. Issues in relation to the facilitation of interaction among students and between teacher and students, the administration of tests and individualised learning factors are explored in an attempt to identify the benefits or otherwise to students of using this system for the delivery of instructional materials.

TopClass Features

Each student taking courses on the TopClass system is assigned a user name and login password. TopClass courses are broken up into Units of Learning Materials or ULM's. An ULM consists of both pages and tests. Students are normally presented with a test after each section or subsection of material. The student is expected to answer the test based on the material covered in the course pages. TopClass has in built email and discussion group facilities.

Research Methodology

The research was mainly qualitative and exploratory in nature, although elements of quantitative research were employed in assessing the frequency and regularity of the students' use of the system. The students' use of the system was observed (using the TopClass systems' management and administrative tools) during the periods of use. Particular attention was paid to how frequently and regularly the different students in each class used the system, and the various system features such as the discussion lists and the course tests. Students' use of the system outside formal class and school hours was also observed. Focus group interviews and questionnaires were used at the end of the school term to gain students' opinions and reactions to using the system.

Research Context

The research was conducted in a town that had recently received a £15m investment aimed at equipping every home and business in the town with a computer linked to the Internet. As part of this initiative the schools in the town had multimedia PCs installed in computer laboratories and were provided with Internet access and usage. Given this infrastructure, the town was seen as an ideal location for this research, with the schools having the computer facilities necessary to accommodate the study. In addition it was envisioned that a high percentage of the students would be able to log on to the TopClass system from home enabling them to access course materials and to take tests outside of school and class hours.

Summary of Main Findings

There was great variation in how frequently and regularly the students in School A used the system during the three and a half month period. The majority of the students' use was voluntary, either from home or during the school's lunchtime period. Students who used the system most frequently and on a regular basis, had access from home and were found also to use the system during lunchtime or whenever the chance arose. In this respect, the students' motivation and their level of access were the factors most influencing their use of the system.

The students in School B experienced a very structured use of TopClass, confined mainly to class time with very few logins from home or during the lunchtime period. As a result all students in this class had very similar experiences of using TopClass.

Overall the students followed fairly logical paths through the coursepages, and felt that the linear layout was straightforward, although this was sometimes a restriction as it was necessary to flick through a number of coursepages in order to find the required page. Given the prevalence of errors and system slowness it was difficult for the students to navigate through the coursepages. The students felt that some of the course content was too text intensive and expressed a preference for more structured, broken up text. However the students expressed very positive reactions to the pictures, diagrams and film files, which they felt were vivid and clear. The students indicated that these aided their understanding and contributed to the fun element of using the system.

The students felt that the tests were necessary in order to focus their attention on the course materials, and expressed a preference for a test after each subsection rather than one overall test. In this way the students felt their learning was more manageable and that the tests provided them with some reinforcement and feedback on a regular basis.

The students used the TopClass email mainly for contacting their friends. Overall the students gave mixed reactions to this feature. Some students felt that it was beneficial to be able to communicate in this way. Others felt restricted in that they could only use the email to contact other people in their class. As all the students had full email access prior to using TopClass, the TopClass email was seen as merely duplicating their private email system and consequently this feature provided nothing new or different for the students.

The students showed limited use of the discussion groups, with the same students found to contribute regularly, whereas the majority of students made no contributions at all. The students who did contribute to the discussion group showed frequent and regular use of the TopClass system and recorded high numbers of logins and test submissions. The students pointed to lack of interest, and a social constraint whereby some students were reluctant to display their opinions for everyone to see, as the main reasons for this limited use. Some students also had difficulty with the structure and layout of this feature. Overall the students felt the discussion group was slow and difficult to use. The students indicated a preference for a chat room as they believed it would be easier to use and that it would allow them to have instant real time interaction with their classmates.

The students' use of the system was constrained by a number of technical problems. The students experienced difficulty logging in to the system, and found that it often took a long time to log in, depending on the number of students trying to enter the system simultaneously. The students were often logged out by the system and found that they had to re-enter their passwords again and again. Coursework pages were very slow to load up and the students were left waiting for the materials to appear on the screen. However these technical problems were due mainly to the ISDN line serving the school being of insufficient bandwidth to accommodate the required number of simultaneous users. Overall the students felt that the system was too slow to be productive. As a result most of the students' use was in small groups at lunchtime or from home. The system ran more efficiently under these conditions, as there were fewer students logged in simultaneously. The students felt that those with access from home were at an advantage given that they were able to complete their coursework in less time than other students were. The students also felt that having the option of working from home afforded them greater flexibility and control over their own learning.

Although some students were more motivated than others, the students' motivation in general was sustained by the novelty factor or fun element of using the TopClass system. The students saw TopClass as fun and using the system provided them with a change from their normal classroom teaching.

Some students felt the need for more normal teaching and indicated that TopClass might be best employed as a support to traditional teacher-centered instruction. The students felt that it was necessary to have their teacher present as an additional classroom resource, who would clear up any misunderstandings, and who would respond to any of their queries.

Using TopClass gave the students the opportunity to use computers and in particular the Internet. As the students had been afforded limited computer access prior to using TopClass, this provided a motivational factor linked to the novelty aspect. Using TopClass allowed the students to learn about the technology as well as the content subject matter. Students using TopClass became more familiar with computers and computer terminology and felt that using TopClass provided the opportunity to learn about two subjects in one.

Using TopClass enabled the students to work at their own speed and to dictate their own pace and rate of learning. TopClass enabled the students to be in direct control of their own learning and provided them with the opportunity to individualise and tailor their learning to their own needs. In addition, TopClass required the students to take responsibility for their own learning and provided them with a high degree of freedom in contrast to their highly teacher directed classroom environment.

Issues Arising from Findings

This study has highlighted the many benefits and limitations of using TopClass in the second-level setting. TopClass provided an interactive learning environment that afforded students flexibility (as indicated by the range of login patterns recorded) and the opportunity to take responsibility for their own learning. TopClass permits students to be in direct control of their own learning and allows them to individualise their instruction by enabling them to work at their own speed and to dictate their own pace and rate of learning. However some students are more receptive than others to taking responsibility for their own learning, and using the opportunities provided by TopClass in a constructive manner. TopClass may be applied at two levels in the second level setting; at the essential level where all core course content is obtained via the TopClass system or at the supplemental level where it provides an additional resource in addition to the core content which is provided in the traditional classroom setting (Harmon & Jones, 1999). High student motivation, as characterised by their willingness to access and use the system, is key to successful implementation if used in the essential sense. Less motivated students benefit from a more teacher-directed or supplemental use of the system. This preserves the role of the teacher as the dominant classroom medium, and avoids the conceptual shift, which is difficult for some students.

Students require a certain amount of structure and guidance when working in such a learning environment and are generally unreceptive to open-ended exploration type activities. Course content needs to be structured in point format, and accompanied by relevant graphics and film or audio files, that will motivate students and hold their interest and attention. Rieber (1999) believes that the majority of current web-based education focuses to a large extent on the presentation and communication of information. As a consequence current web-based instruction is very "explanation heavy," both in words and pictures, to the detriment of more "dynamic interaction" between the student and the content subject matter (Rieber, 1999 [Internet]). Rieber (1999) on the other hand emphasises the need for interaction between the students and the content subject matter, so that the student has the opportunity to process and manipulate the information akin to the constructivist learning theory (Merrill et al, 1996; Hedberg 1989).

Jonassen (1998) points out that instructional technologies have been traditionally used as conveyors of information.

> Technologies as conveyors of information have been used for centuries to 'teach' students by presenting prescribed information to them which they are obligated to 'learn' (Jonassen, 1998 [Internet]).

Wager (1998) refers to this as the content model. Several researchers have called for a reassessment of this approach to accommodate a more constructivist view of the learner (Cunningham & Duffy, 1996). Hannafin & Land (1997) have suggested that instructional design should focus on developing open-ended learning environments. Jonassen & Tessmer (1996-1997) propose that a greater range of learning outcomes, whereby learners are required to explore, reflect on and apply information, is essential for meaningful learning to occur. Taken with students' reactions to text-intensive content, this points to a need for course content which incorporates a problem solving approach (Gagne et al, 1998).

Students' participation in and use of utilities such as email and discussion forums will be linked to necessity. Students will not participate unless it is necessary or beneficial for them to do so. Students through years of didactic teaching have been conditioned to be passive receptors in the education process. Students prefer to be anonymous members of the classroom setting and as such are worried about what others will think of their opinions, and are embarrassed by having their comments displayed for all to see. Myers (1999) has recognised the impact of these factors;

> Some learners are not comfortable with technology based training (TBT) as it demands that they actively participate. TBT forces learners out of an instructor lead classroom mode of passively absorbing instruction and places them directly into the process of learning...Another reason for learners' discomfort is that they have been conditioned by years of didactic one-way instruction followed by a weekly test. While it is possible to be anonymous in most classrooms, it is possible to be anonymous in well-designed interactive TBT instruction. Perhaps the fascination with passive non-structured learning on the Web is an extension of the anonymity people use as a buffer in the classroom (Myers, 1999, p.51).

Fullan (1991), Hull & Ruddock (1980) (cited in Fullan, 1991) and Saye (1997) all report that pupils' interpretations of their traditional roles in the classroom can impede change. In addition Ritchie & Wiburg (1994) noted that "traditional perceptions of what teaching, learning, and knowledge should look like are major limiting factors to integrating technology"(Ritchie & Wiburg, 1994, p.152). Any innovation that requires students to do something new will succeed or fail based on students' actual participation. Students will participate, according to Fullan (1991), if they understand, have the necessary skills, and are motivated to try what is expected.

Whilst there are potential benefits, there are also number of issues hindering the implementation of Web based components such as TopClass into education.

Provision of sufficient access to the Internet, both in school and outside the formal school environment is essential to achieve greater use and integration of systems such as TopClass in education. This is especially so if TopClass is to be employed in the essential sense, when all of the core course content is obtained via the TopClass system. Sufficient access to the required technology is a prerequisite for effective use of such a system. Students believe that the increased availability of computers and online technologies, as provided for in initiatives such as the Irish IT2000 policy, is not being transmitted into sufficient exposure at the school and classroom level. Increased access is required so that at the very minimum students possess sufficient IT skills when they leave school. Provision of the necessary technologies in the home is essential if online technologies are to be used in anything other than a supplemental sense. This poses a very real problem for educational planners and policy makers of how to tackle educational disadvantage in this respect. The failure to redress this issue will contribute to a two tiered system between the haves and the have nots, which is practically and morally unacceptable (Lafierre, 1997; Jedeskog, 1998; Malone, 1998). Techno poverty will become the new disadvantage.

Whilst such barriers may be eliminated through increased investment and policies which aim to redress educational disadvantage, especially with respect to the availability of educational technologies in the home, it is not sufficient to assume that availability of the technology alone, will lead to the use of this system in the long term. In this case the majority of students who had the technology necessary to access the system from home availed of the opportunity to do so. However successful and prolonged adoption of this innovation in the long term will also require a motivated and committed learner who is willing to take a certain amount of responsibility for their own learning. Such a learner must be willing to become self-sufficient, to work independently from their teacher and to continue using the system even after the initial

novelty period has worn off. In the words of Fullan (1991), such a student response, of heightened interest and engagement is "central to any school improvement effort" (Fullan, 1991, p.183).

The prevalence of technical problems results in much negativity arising out of system slowness, various errors and login problems. Such problems render the implementation of TopClass impractical, especially in the whole class setting, and necessitate alternative arrangements, which contribute to problems regarding students' access to the system. It is essential that on the spot technical assistance be available from technical staff familiar with systems such as TopClass and that schools' hardware and networking systems are configured to ensure optimum performance. Currently ongoing technology support is regarded as something of an optional extra, which is often provided informally by a motivated member of the school staff (Lyndes, 1995). However as technology is integrated more into the education experience, formal, planned models of support are increasingly necessary. Many researchers and educational planners link successful implementation with the provision for technical support. According to the Southern Technology Council (1997);

> The success or failure of school-based technology implementation is all too often a function of the availability of responsive, customer-friendly technical support. Technical support plays a major role in successful educational technology implementation...both practitioners and policy makers need to keep this foremost in their minds when making planning or funding decisions (Southern Technology Council, 1997 [Internet]).

Reliable and easily accessible software, and where necessary technical support, is critical for successful implementation. The alternative is frustration and resentment in the learners whom it is meant to benefit.

Conclusion

The majority of Government initiatives to integrate the Internet and World Wide Web into education have been primarily concerned with establishing Internet connections within schools. Whilst it is a definite prerequisite, it is premature to think that Internet access alone will ensure the integration of technologies such as TopClass in the school setting. Full integration for the average student requires a shift in learning culture, from passive receptors of information and facts, to active participants in the learning process. Students through years of didactic teaching have been conditioned to adopt such a role, and are not yet ready to adopt a system such as TopClass as the dominant classroom medium, or as a replacement for their teacher. Utilising TopClass as a classroom resource, or as a supplement to the normal teaching preserves the role of the teacher and affords students the opportunity to take some responsibility for their own learning. Taking such an approach initially provides a stepping stone, whereby students as they become more accustomed to such technologies, and as there is a gradual shift in learning culture from teacher to student centered, might be able to integrate and use such technologies on a more essential basis. As time progresses the greater impact of communication technologies in education will eventually alter current curricula to provide for the new opportunities presented by the use of this new technology in education. Provision of the technology alone will not influence the nature of education, rather it is the way this technology is used to redefine the learning experiences presented to students either in the classroom or outside the formal school environment.

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AN ONLINE TUTOR COMMUNICATION MODEL

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Introduction

The increasingly widespread use of ICT in education has brought about significant changes in learning strategies and teaching techniques. Online education is currently attracting great interest and is the subject of many studies: one such [1], describes in detail an online education model. This article examines the role of the tutor in the new teaching/learning paradigm, where he/she is no longer seen as the sole repository of knowledge but rather as a facilitator in the learning process. As learning arises from exchange and collaboration among members of the learning community, the tutor must know how to stimulate discussion and facilitate the process of new knowledge construction. The functions a tutor carries out differ from those traditionally carried out by the teacher; there are specific duties to perform, which will be described in this paper. The basic hypothesis underlying this article is that the tutor's role and working style are essential to the success of a course. In the first part, we outline a general profile of the online tutor, while in the second we describe in detail the tutor's activities and sketch out an *online tutor communication model*, drawing on actual experience gained in an online course called MEDEA[1].

Profile of the online tutor

The *learning community* comprises the whole population involved in an online course, namely learners, tutors, experts, technical staff, and, in some cases, observers. The co-presence of experts and tutors within the community is an early clue that the role of the online tutor is not necessarily to deal with the specific course contents, but rather to facilitate the learning path and arrange its elements, organise and orchestrate the various actors that make up the learning environment, guiding them and steering them towards the achievement of the learning objectives set within the course. Close collaboration among all community members is the key to the attainment of learning goals and the overall success of the course. On this point, many authors have stressed the influence that *peer tutoring*[2] exerts in the education process: strong emotional ties are formed between fellow learners and these may have positive effects on both motivation and knowledge acquisition. The online tutor therefore becomes central in the new learning paradigm; his/her main role is to create and transmit the "intellectual climate" of the course [2], to make the most of the students' qualities, to provide real learning experiences, and to define approaches designed to overcome the lack of physical contact between students. The principal roles of the tutor in online courses are identified in numerous models and are summarised by Berge [3] thus:

"The successful running of an online course calls for many basic elements, which I have categorised in four areas: pedagogic, social, managerial and, lastly, technical" (Zane L. Berge).

When performing the "*pedagogic*" role, the tutor must act as an educational facilitator, focusing discussion on key areas of the course contents by way of targeted questions and stimuli. In addition, if the course is to be successful, it is important to maintain maximum flexibility and above all a non-directive style so as to encourage participation and interaction. Acting in a "*social*" role, the tutor must create a friendly, comfortable environment by stimulating participant interaction and fostering group cohesion, thus helping to develop a collaborative atmosphere. Acting as course "*manager*", the tutor must plan the course, co-ordinate activities, lay down the "rules of the game" and each player's role. In this capacity the tutor must give a strong sense of leadership - after all, the success of the course may depend on how it is run. Lastly, the tutor must provide technical support, making the learners feel at ease with the CMC

[1] The MEDEA course was designed, developed and run by ITD/CNR and funded by the Italian Ministry for the Environment. For more details about the course, visit the EuMEDEA web site: http://paradiso.itd.ge.cnr.it/english/projects/t3/eumedea/ . This edition of MEDEA was developed at European level within T3 - Telematics Applications sector of the IV Framework Program.

[2] This is the process whereby learners teach fellow learners.

(Computer Mediated Communication) system so that they can concentrate on the contents. So the tutor relinquishes some of the traditional teaching duties and takes on new ones. Quoting a study by Benne & Sheats (1978), Davie [2] suggests some the abilities a tutor needs to have, distinguishing between *abilities for structuring and facilitating group discussion* (in this case the tutor acts as initiator, informer, commentator, co-ordinator, mediator, critical observer, stimulator, technician, etc.) and *abilities for building and maintaining the group* (here the tutor needs to encourage, harmonise, mediate, observe, provide alternatives, etc.). The element that characterises interaction among members of the learning community is the written message, which, as Umberto Eco states *"has a significant form that may be filled with different meanings"* [4]. In face-to-face communication, the significance of the message is clearly conveyed by a number of 'signs' (hand gestures, tone of voice, facial expression). Together with the context, these help the recipient to decode the message, to understand whether it's, say, a joke or a command. By contrast, in text communication the writer has to specify context and significance and make it understandable to the reader. Therefore written communication plays a crucial role in the success of an online course. The written message is the online tutor's vehicle, the means for performing his/her role. If the tutor is to perform successfully, he/she needs to provide appropriate qualification of message significance, using special elements that help to make the reader aware of the sense, value and significance of the message.

An online tutor communication model: the MEDEA experience

The duties of the online tutor are several: he/she may be called upon to participate either in the initial phases of course planning (publicising the course and recruiting participants, providing study material), or at run time.

Publicising and recruiting participants

The first duty an online tutor may have to perform is participant recruitment, in other words publicising the course. In this case the tutor needs to choose the communication channel best suited to the population to be addressed and must fix the criteria for accepting applications. In MEDEA, a variety of publicising strategies are used, ranging from sending information leaflets or emails to school principals or Directors of Education, to the inclusion of MEDEA in the official programme of activities proposed by the organisation concerned. This approach maximises the number of contacts made. The MEDEA information leaflet contains a description of the course, its objectives, structure, instruments required, and scheduling. It is crucial right from the outset to make clear the expected workload that participants face (in terms of the minimum number of hours required), as newcomers to online education will find this extremely hard to gauge. In any case, it is vital to eliminate any preconception that online courses are less demanding than face-to-face ones.

Preparing material

Alongside recruitment, the tutor is also involved in preparing study material. For online courses, materials regard: 1) course organisation and structure; 2) technology employed; 3) contents [1]. Over the course of the various editions of MEDEA, a fully fledged participant's kit has been developed, containing all the material required. In some cases an ad hoc web site may be set up; as well as containing the course guide information and technical notes, this may also gather together other course material (material initially provided by the tutor, that put forward by the community during the course itself, and finally the course "output", namely the final products the participants produce as the course progresses). This leads to the creation of a kind of virtual course library that is updated with each new edition of MEDEA. The adoption of a web site is a response to clear needs [5], namely:

- the need to store large quantities of materials that support different codes (text, image, sound);
- the importance of providing an open environment connecting the various sources outside the course;
- easy updating of material;
- the possibility of making the participants' products accessible to the general public.

The MEDEA web site is used not only to store course information and material but also to showcase the course itself. At the end of each module, the tutors produce a progress report which provides the outside world with an up-to-the-minute picture of how the course is proceeding.

Face-to-face activities

Once recruitment and material preparation have concluded, it is important, even in distance courses, to schedule occasions where the various members of the community have a chance to meet up and swap ideas. At these events it is vital for the tutor to keep track of proceedings as much as possible, both by keeping any documents produced and, say, taping the discussions that are held for later review and analysis. These face-to-face events are usually held at the beginning and end of the course.

Kick-off meeting

Before commencing activities, the online tutor holds a face-to-face meeting to help break the ice and foster the formation of a learning community. The main objectives of the kick-off meeting are:

- to present the general characteristics of the online course (the course plan, the objectives, the methodology adopted, the modules and activities foreseen);
- to stipulate the psychological contract, which, although having purely an emotive and cognitive value, clarifies the reciprocal expectations of the actors in the learning process [6];
- to get the various members of the learning community to socialise together;
- to allow them to practice installing and using the communication system adopted;
- to deliver the learning material.

In the editions of MEDEA, the kick-off meeting has gradually become an integral part of course activities. The tutors plan socialising activities (individual presentation, role play, identification with a flower, animal, food, etc. in order to break the ice and overcome shyness) as well as activities designed to gauge the expectations of the various actors, for example using questionnaires. Where it is not possible to hold a face-to-face induction meeting (e.g. when participants are spread over a wide geographical area), it is nonetheless necessary to organise online socialisation activities (for example in the European edition, EuMEDEA [7], a video conference was used).

Wind-up meeting

Holding a wind-up meeting at the end of an online course gives the tutor an opportunity to make an evaluation, to ascertain the strong and weak points of the course plan and of how it was run. The participants, on their part, have the chance to weigh up the experience, to compare their impressions with their initial expectations and to tighten their links with other members of the community. During the MEDEA wind-up meeting, the tutor holds plenary discussions and group activities, as well as examining the "hot topics" that emerged during the course (e.g. regarding written communication, contents, interaction, methodology, course, role of the tutor, etc.).

Online activities

Facilitating communication

The conclusion of the face-to-face kick-off meeting paves the way for the official commencement of online activities. From this moment until the wind-up meeting, communication between participants and tutor will be in textual, computer-mediated form. This is where the tutor's role as the communication facilitator becomes crucial, a role he or she will play constantly throughout the duration of the course. It involves making the participants comfortable with communicating via written messages, helping them to overcome any fears or embarrassment this may cause. Accordingly, the tutor will use - and promote the use of - an informal style of language that borders on the colloquial. To make up for the lack of non-verbal signals, which might lead to misunderstanding, the tutor makes use of emoticons, colours and formatted text, and, where needed, calls on participants to clarify the meaning of their messages.

Sometimes he/she deliberately inserts some small mistakes to demonstrate that messages need not be syntactically perfect [2]. MEDEA makes use of another strategy to help convey the exact intention and tone of a message. The message window in the computer conferencing system can be modified, and this feature has made it possible to insert a sort of grill containing a message taxonomy (for a detailed discussion, see [8]). The tutors invite participants to use this grill in order to indicate the type of message they are sending. This has a twofold effect: it makes the writer reflect further about the content and form of the message he/she is writing, and at the same time gives the receiver a general idea of the intention behind the message, thus reducing the possibility of misunderstanding and making communication more streamlined.

The tutor's communication acts

Besides the general role of communication facilitator, the tutor performs actions that are translated into written messages, into *communication acts* that are typified and repeated. Hence we can define a model for online tutor communication, one that comprises six main message/action types: module commencement, activity support, tutor analysis and invitation to discussion, discussion moderation, conclusion of the module, and technical support. These are examined in detail below.

- Module commencement

At the outset of each module, the tutor normally provides a general picture of the topic at hand and of the module activities. At the commencement of modules in MEDEA, two types of message are sent, namely the *"module commencement message"* (see Fig. 1) and the *"operational instruction message"*. The basic idea is that a clear, recognisable message form helps the reader to absorb content better. The *"module commencement message"* covers four distinct categories of information: description of the topic at hand; description of the objectives to be reached; general description of the activities to be performed (the practical 'tool' for reaching goals); schedule of major deadlines to be met. Once the module has been outlined, the tutor provides the participants with a detailed list of activities to carry out. In MEDEA, the tutor sends an *"operational instruction message"* for each single activity set and uses this as a space-time marker in the module (i.e. an operational instruction message = an activity). This message usually comprises: a description of the goal to be reached, available material (bibliography to consult, forms to fill in, examples of final products); proposals for introductory activities, schedule for completing the activity.

DESCRIPTION
Up to this point in the course, we've **chosen the specific environment** to be studied in our project and **defined the goals** of that project. So now we've got **a model** describing the elements and relationships within the environment (system).

OBJECTIVES
Bearing in mind these **previous phases**, we're now going to:
- **connect these topics with the syllabus** in the various school subjects;
- **plan activities;**
- **outline and develop the material** to be collected from the activities for creating the chosen product…

MODULE PHASES
The module will be divided into two stages. These are:
PHASE 1: CONCEPTION/CHOICE OF A PRODUCT
We'll **discuss** together what it means to "conceive" a product, how to choose a product and why. Then we'll get to **choose one**! During the phase we'll refer to the message **Operational instructions for Activity 1.**
PHASE 2: DESIGN
In this phase we'll design our pathway/project, which means we'll identify topics, the subjects they belong to and the material we'll collect during the project. During the phase we'll refer to the message **Operational instructions for Activity 2.**

DURATION AND DEADLINES
The Modelling Module will last 5 weeks, with intermediary deadlines:
- Phase 1: **from Tuesday 8 to Monday 21 February (Activity 1)**
- Phase 2: **from Tuesday 22 February to Monday 13 March (Activity 2)**

Figure 1: Example of a *module opening message*

- Activity Support

After reading the opening message and instructions, the participants study the topic at hand individually. The online tutor has the task of clearing up any doubts that emerge, restating proposals and providing more precise explanations about the activity to be performed. To keep the online communication alive and help participants reintegrate with the group, the MEDEA tutor uses a *"progress report message"*, which contains: description of the progress being made; questions or points that arose which may be of common interest; progress report on each group's work (quoting some of the original text); encouragement to carry on. As deadlines approach, the tutor sends out a reminder urging participants to get work in on time. Finally the tutor sends out an *"activity solicitation message"* that contains: encouragement to tackle the problems that have arisen; a list of the participants who have completed the activity; explicit calls for outstanding work; invitations for online discussion of problems, doubts and difficulties.

- Tutor analysis and invitation to discussion

After completing the activity, participants make the documents they have produced accessible to the community, and the tutor analyses and comments on each of the products received. The MEDEA tutor sends feedback using an *"activity comment message"* that contains: thoughts about the working strategy used; advice about aspects to be improved; calls for clarification (where necessary); appreciation of work carried out. To avoid individual relationships becoming biased, the tutor comments on more than one product in each message. The tutor subsequently invites participants to discuss the activity online and to swap views on the various approaches adopted. The MEDEA tutor activates this exchange among community members by sending a *"discussion proposal message"* that contains: points gleaned from the documents read; specific questions that focus on various aspects of the topic studied; experiences or news that might prove interesting to participants and that illicit a response.

- Discussion moderation

One of the essential duties of the tutor during online work is to moderate discussion. This involves stimulating discussion and encouraging the exchange of opinions, as well as avoiding double-track discussion by finding and stressing points of agreement and disagreement. The moderator helps to keep the discussion in focus, avoiding conceptual snarls and revitalising the discussion. Feenberg [9] uses an evocative image, representing CMC as a board game in which each move (i.e. message) opens the way to the next one. The aim of the game is to avoid the final move, so the moderator's role is to offer the players as many alternative moves as possible.

- Module conclusion

Just as it is up to the tutor to announce the opening of the module, it is also his or her duty to declare its closure and usher in the next phase. At this point in proceedings, the MEDEA tutor writes a brief appraisal of the module, of the level of participation and of the way the virtual community interacted (citing participants' comments where necessary). The tutor also gives the final results of the activities performed.

- Technical support

It is useful if the community includes actual computer experts who can come to the aid of members with technical problems. In any case, to avoid problems brought about by inexperience, the tutor ought (especially in initial familiarisation with the system) to set a "technical" exercise to help members gain confidence with the CMC system. MEDEA features a conference area called "Laboratory" dedicated to technical matters, and the tutors sometimes set brief exercises (in parallel with activities in other modules) to give participants practice in using the software.

Conclusions

This article has outlined a profile of the online tutor on the basis of experience gained in the MEDEA course. We have considered the tutor's functions and devised an "online tutor communication model", on the presumption that in an online course the tutor takes a number of "standard" steps and these can be identified and defined on the basis of the typology of messages sent in the various phases of the course. In addition, we have provided specific suggestions for tackling the problems that the tutor is likely to face, drawing on the many solutions adopted over the years during the various editions of MEDEA.

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THE SCHOOL OF TOMORROW: A SCHOOL OPEN TO THE WORLD EXAMPLES OF ELEMENTS OF GOOD PRACTICE.

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Abstract

One of the challenges that Education faces today is to bring the benefits of the Information Society within the reach of all students, in the form that is most natural to them. The new ICT based educational tools must not be imposed as a substitute to the conventional teaching but rather as an add-on that has to justify its introduction through the qualitative upgrade it offers to every day school practice. The vision of Ellinogermaniki Agogi for the school of tomorrow is that it will not be an island, a self-contained campus, a counterworld. The school of tomorrow will be able to emit and absorb along different wavelengths, be immersed in contemporary culture, be open to the emotions, facts and news of its time. It will be permeated by society, but not unprotected: the relationship between school and society will be one of osmosis, where new educational tools and learning environments - giving the proper weight to the pedagogical aspects and developed according to well-defined educational frameworks- filter, guide, and act as a membrane and interface.

1. Introduction

The Research and Development Department of Ellinogermaniki Agogi is actively involved in the development of advanced educational material and web-based electronic tools that make full use of the dynamic of the Information and Communication Technologies in Education. In the presented paper, the educational concepts that underlie the application of the developed electronic tools and their technological characteristics are presented in detail. Six innovative educational tools are also described as application examples, namely the electronic tools developed in the framework of the projects **AgroWeb** – NETDAYS 1999 [1], **YouRA** - SOCRATES-ODL [2], **e-Hermes** - SOCRATES-ODL [3], **Artemis** – SOCRATES-LINGUA-D [4], **Athina** - SOCRATES-LINGUA-D [5] and **EuroSPIn** - CONNECT INITIATIVES [6].

2. Educational Concepts

The presented educational tools are developed on the basis of the following educational concepts:

- **Enhancement of a constructionist approach to teaching**. In the adopted approach learning is the outcome of formulating questions, investigating, researching and sharing results (**e-Hermes, YouRA, EuroSPIn**). In this way motivation of students is increased, as they are more likely to feel of personal investment in a scientific investigation and as they actively participate in the research procedure. Moreover, they develop critical thinking since now knowledge is the result of healthy scepticism and not just acceptance of new information. Finally, students gain firsthand experience in the ways that technology design can both serve and inspire scientific investigation [7].
- **Development of an interdisciplinary model in current educational practice**. It is held that interdisciplinarity is crucial towards enhancing the effectiveness of education, since it provides a unique way of strengthening learning processes, such as discovering analogies, similarities etc., while providing application examples, which are inherently closer to real world problems. The main link usually missing in the learning process is that students do not learn sufficiently through experience but through a systemic model based approach, which does not (as it should) emerge out of the culmination of learning efforts but in many cases it is the starting point. A particularly disturbing phenomenon, that is common knowledge among educators, is that students fail to see the interconnections between closely linked phenomena or fail to understand the links of their knowledge to everyday applications. Therefore, in recent years, there is a **clear focus on interdisciplinary education**. This approach supports that educational experiences should be authentic and encourage students to **become active learners, discover and construct knowledge**. Authentic educational

experiences are those that reflect real life, which is multifaceted rather than divided into neat subject-matter packages. Indeed, interdisciplinary instruction exploits the natural and logical connections that cut across content areas and is organized around questions, themes, problems, or projects rather than traditional subject-matter boundaries (**AgroWeb**, **EuroSPIn**). Especially these two projects promote the **informal learning**. In these projects the educational concept is not transmitted in a theoretical way but rather in a biomatic way in the form of a real life experience. On the other hand, teachers are faced with a real challenge. Having specialised in an academic discipline may cause frustration to them when it comes to creating interdisciplinary, cross-curricular activities. Such activities demand considerable knowledge in many areas, which they may lack. Collaboration with their colleagues may help them overcome this challenge, develop positive attitudes to interdisciplinary learning and gradually adopt it and make it part of their teaching practice (**e-Hermes**, **YouRA**).

- **Learning should be a collaborative experience:** It is widely held that increased students' participation stimulates interest and enhances learning. Furthermore, students' collaboration and interaction is one of the most essential characteristics of success of the didactical approach. In the AgroWeb project students were asked to identify traditional agricultural products that played a significant role in the history and in the socioeconomic development of the area. In the e-Hermes and YouRA projects students were asked to take environmental measurements with scientific or hand-made instruments, while in the EuroSPIn project students were asked to conduct interviews as journalists, analyse the results and write a report. The electronic tools have been developed to facilitate the creation of a **"virtual classroom"**. In this new classroom students and teachers from all European countries come into contact exchanging ideas and experiences. Every possible aspect of a conventional classroom is simulated. In a real classroom students' collaboration and interaction is one of the most essential characteristics of success of the didactical approach. During the dialogue questions or comments of one student can be addressed and answered from a remotely located classmate or teacher. Through the use of the tools and their involvement in the above-mentioned projects, students from European countries get to know each other and thus cultural elements are transmitted. World state friendship can only be forwarded on a person-to-person basis. This can be achieved when people from different nations work together with common aims and objectives. This goal of promoting transnational cooperation and the use of new technologies to overcome barriers to physical mobility is targeted with the use of the presented electronic tools.

- **Equal and parallel development of pedagogical and technological innovations.** The involvement of the pedagogical community in the development of the innovative technology is relatively small. In most cases the educational experts are just criticising technological applications, usually negatively (e.g. video games, hand held computer games). Furthermore teachers and students are excluded from any contribution to this development. We believe that, as far as it concerns educational applications, the technological innovation must be designed with educational targets and criteria. In the presented project technological innovations were designed to serve clear and specific educational demands. During the development of the presented tools students and teachers came together with science researchers, psychologists, and technological and educational experts to contribute to the re-engineering of the school of tomorrow and test and evaluate the new ideas, concepts and technologies in real school environments. The electronic tools, developed with the collaborative effort of academics, software developers, teachers and students, are serving as the connecting link between research and the users. The tools are results of scientific pedagogical research, applications of innovative technology and finally add-ons to the educational process that serve clear educational needs expressed by teachers (**YouRA**, **e-Hermes**, **Athina**, **Artemis**). The applied methodology ensures the active participation of all parties, as it is proceeds in the following way: First a prototype version of the tool is being developed according to the guidelines of the academics. Teachers are also involved in this stage providing significant input from their teaching experience. These cycles of school-centred work are not only meant for evaluation purposes (technological and pedagogical) but involve teachers and students in giving direction to the project and its technological and pedagogical results. The aim is to help both teachers and students reach beyond "clichés" to the areas in which they can make **the most valuable contributions**, and **potentially increase their role on the world stage afterwards**. To assure maximal usability of the new tools, optimal adaptation to the local environments and realistic evaluation of the pedagogical effects, the developed software add-ons use a heavily **student-centred approach**. This will be achieved by using real school environments in many European countries.

- **Innovative pedagogical and technological aspects have to be systematically evaluated.** Most electronic tools (software, CD-ROMs, Internet sites) used in education have never been concretely evaluated. It is our strong belief that the evaluation of the pedagogical impact of the tools is a very important aspect. The evaluation of the electronic tools of all the presented projects was performed according to an academic valid scheme, based on well-defined methodologies. The aim is to develop a better theoretical framework on how different types of tools and learning environments support different types of thinking, reasoning and understanding. The research process includes quasi-experimental design (pre- and post achievement tests in control and experimental groups) and on-field observations (interviews, teachers logbook, video captures). In the educational aspect a complete evaluation of the student's learning and of the adopted pedagogical framework is performed in all cases. From this accurate evaluation scheme arguments in favour of the need for wider spread of new practices in everyday teaching arise. The evaluation results were also used as an input in the final redesign of the tools.

The aforementioned pedagogical concepts govern the scientific research in the fields of Pedagogy and Educational Technology. This research is in principle necessary to be performed in a large multinational community for science advance and broad benefits. The developed tools are results of collaboration of complementary expertise in the fields of technology, communications, basic research, educational software development, education, science teaching and pedagogical psychology, a group that can be brought together only in the dimensions of the European Union. This pluralism on the other hand is what is going to safeguard the cultural diversity of Europe, a unique driving force against the establishment of a mono-cultural world. As Viviane Reding, member of the Commission, responsible for education and culture has stated out: "All our European nations have splendours to offer. And European cooperation has proven that it has great deal to offer, both to the quality of education and in making the best use of cultural diversity, by widening access to our collective reserves of experience, knowledge and talent."[8].

3. Technological innovation

In most of the cases educational software is provided in CD-ROMs, not allowing for any interaction with the user. Educational applications on the World Wide Web use the Internet mainly as an information and communication tool. The Internet though is not static. It offers great possibilities for the promotion of the interaction of remotely located users. The presented real time data processing tools were developed with the aim to facilitate, encourage and promote this interaction. In parallel those tools as well as other tools developed as web-based software provide the platform to use the Internet as an Open and Distance learning forum. The effectiveness of the technological platform of the presented tools has been systematically evaluated with respect to their user-friendliness, adaptability, operability, functionality and engagability, in real conditions through two cycles of school centred work (test and final runs). In all cases a **user-centred development approach** has been adopted [9].

All presented tools have real time data analysis capabilities. Our aim for the developed educational tools is for them to be fast processing tools, free from complex procedures, giving students the opportunity to easily access the data on demand. The open architecture of the tools allows for additions, modifications and improvements in their introduction to the real school environments as well as for future expansion. The tools allow for full freedom in the selection of the parameters plotted, the axis, the time window, etc.

The electronic tools are distributed exploratory learning environments, facilitating the learning process. These tools are compatible with graphing and real-time analysis software components (**YouRA, e-Hermes, EuroSPIn**), so that students can easily investigate trends and patterns in the data they collect. In the case of the **Athina** and **Artemis**, the language learning environments are making heavy usage of interactive multi-media applications (video, authoring environments etc.). Finally in the case of the **AgroWeb** project an electronic shop has been developed giving the participating students the possibility to promote and sell the agricultural products of their areas. It has to be mentioned that the older the students get the more sophisticated the tool becomes in terms of its functions. For younger students emphasis is placed on the presentation and displays of the data.

To promote constructivism, the modelling theory and qualitative reasoning through these developed exploratory learning environments, we use mostly diagrams as representational tools. For the electronic tools of **e-Hermes**, **YouRA** and **EuroSPIn** we have selected the plots since such tools are essential for competent modelling and problem solving.

The constructed electronic tools provide students total independence in choosing any combination of variables, the scale and additionally any combination of data onto comparative charts. This way it is actually the students who draw the diagram, not the computer, since they set all the parameters. Additionally they draw it quickly, as they do not use any pen but the tool executes their instructions. This, by any means, does not imply that students must not draw diagrams by hand. Simply it is the only way to make them use diagrams for every phenomenon they study without loosing a lot of time during the lesson or the science laboratory.

The benefits of using these diagram-oriented tools are multiple. Students can see how a plot is altered when scale changes. They learn how to choose the diagram scale in order to study a detailed part of a diagram or to have a more general view. They learn how to take into account the accuracy of the data. They learn to use diagrams in order to find possible correlations between several variables and to test their model of the phenomenon they study. Using certain teaching strategies, we stimulate students to use these plots to articulate their own models, to make predictions grounded on them and to make explicit comparisons between their own diagrams and the accepted scientific models (**e-Hermes** and **YouRA** in science teaching and **EuroSPIn** in social studies using statistical methods). In the case of the e-tool of YouRA project **special emphasis was given in the possibility of non-verbal communication, communication based in the use of drawings, photographs and video.**

The electronic tool for AgroWeb was developed with the standards of a commercial electronic shop. In the presentation of the products the students had the main responsibility. The electronic tool of **Athina** (and consequently of **Artemis**, which is still under development) includes a multitude of interactive applications (interactive exercises, distributed authoring environments, web-based books, multimedia tailored for the Web) for the on-line courses.

4. Application examples

In the following the six e-tools and the corresponding projects are presented in detail:

- The **AgroWeb** project aims at the exploitation of the new Information and Communication Technologies (ICT) for the development of an environment that promotes interdisciplinary approaches and makes full use of the capacity of informal learning. In the framework of the AgroWeb project students from four European countries collect information about the agricultural products of their region, which they present in the Internet. In parallel with the presentation and promotion of products the students try to demonstrate the characteristics of their region (customs, traditions, geographical and climatological particularities). Students also endeavour the sale of products through an electronic shop that has the form of an interactive web page. **The electronic shop, the Agora,** is not just a simple place of transaction of goods. Agora is also a means of communication for students from different European countries. Students communicate with their virtual fellow students, they get to know the products of other regions and the cultural and social elements of those regions. **Agora is therefore a multidynamic meeting place and a place for the exchange of ideas.** The students developing the electronic shop realize in practice the meaning of the common European market and its common currency, **the EURO**. In the framework of the AgroWeb project the students expand their knowledge in subjects, like Informatics, History, Geography, Mathematics, but also on basic elements of Economics. They realize the advantages and disadvantages emerging from the collaboration over distance with fellow-students that live in different countries and different social and cultural backgrounds. The familiarization of teachers and students with the new technologies as well as the introduction of interdisciplinary subjects, such as economics or ecology where global interactions consist significant driving forces, present new possibilities and challenges for the implementation of Open Distance Learning practices in secondary and primary education. In the school of tomorrow there must be a reorientation and redefinition of the role of the teacher, targeting a more active learning. The AgroWeb project and its developed electronic tool support this transition within a primarily pedagogical frame, where the technological innovation serves specific needs of the educational practice.

- **The YouRA (Young Researchers in Action) project** aims at the development and application of a pedagogical framework suitable for the implementation of Open and Distance Learning (ODL) to 10-13 year old pupils. In parallel and in the framework of the project, the training of teachers in the use of new technologies in ODL practices is targeted.
  In the framework of the project a web-enabled software has been developed that has the form of an interactive web page and allows students input and handling of meteorological data. Weather related phenomena have been selected for the pilot implementation of this pedagogical framework for two main reasons:
  - They are of great interest to students of that age
  - The study of meteorological phenomena has a highly interdisciplinary dimension

  Since in this age students do not easily use foreign languages, during the development of the electronic tool special emphasis was given in the possibility of non-verbal communication, communication based in the use of drawings, photographs and video. In the electronic tool's data display, the step-by-step abstract thinking and the familiarisation of students with plotting data is endeavoured. The students using the electronic tool input the data that they acquire using four meteorological instruments, which they build by themselves from plain materials and with simple means.

- **The e-Hermes project** aimed at the development of a pedagogical framework suitable for Open and Distance Learning (ODL) implementation in secondary education. The innovation of the project lies in the development of **a software add-on, the "electronic tool" which has the form of a web page that is promoting students' interaction and fully exploits the new Information and Communication Technologies.** The participating students collect environmental data, covering a broad range, like weather related and energy related data and more complicated data (noise, UV and EM radiation), and enter their measurements into the e-tool, which can analyse and plot the data in real time. Its user-interface was developed in order to address clear educational needs. Its main feature is the provision of full freedom to students in choosing the form, the axis and the time interval of the graphical representation. Using the e-tool students become familiar with scientific methodology and plotting and identifying the quantities that depend on each other. During the project's implementation high school students in ten European countries used the e-tool. They collected data; they entered the data into the database and analysed them using the e-tool. They concluded to observations that discussed within their virtual classroom and finally published their results in the project's magazine. For the teachers the co-ordination of the **virtual classroom** is a challenging experience and at the same time a new educational reality. Teachers face their new role in a virtual classroom, not as the centre of teaching as a source of transmitting knowledge, but rather as a co-ordinator of the teaching process.

- **The Artemis and Athina projects** aim at the creation of an advanced technology language course for the teaching of Modern Greek through various educational channels. Artemis project is covering the introductory level, while Athina project is devoted to the advanced level of learning the Greek language. Athina's material has been already tested and evaluated in 3 European Universities teaching the Greek language, while the introduction of Artemis material will start in September 2000. The projects develop written material, CD-ROM, DVD-ROM with interactive multimedia and use digital video and advanced Internet platforms for facilitating Open and Distance Learning (including interactive applications like video, distributed authoring environments, web-based books etc.). The communicative approach to language teaching is at the core of Artemis and Athina's materials. Both projects take advantage of the multimedia and the Internet in order to provide for more flexible learning. The language course follows a communicative pedagogic and didactic approach to language teaching with emphasis on the cultural dimension. The material will be based on themes of contemporary life in modern Greece, including cultural aspects and traditions. This approach is both pragmatic and highly yielding.

The main pedagogical principles that underlie the projects are:

- Presentation of subjects through a cultural perspective
- Communicative presentation of subjects
- Exercises to develop expression skills
- Activities to support active learner-centred learning as opposed to guided teacher-centred learning

- **The EuroSPIn (European Student Press Initiative) project** aims at the development of a model of cooperation between the media and the schools throughout Europe. Within the aims of the project is also the development of a model of active civic education that allows students to participate in research efforts. In the framework of the program students perform a research with questionnaires and interviews on the preferences, attitudes, political beliefs and ideological dispositions of European youth, under the supervision of specialized experts who will collaborate with the students and the teachers participating in the project. The results of the research effort will be analysed by the students and published in European newspapers (TA NEA, Curier, le Monde).
  The project promotes tele-working and European collaboration. The students and the teachers participating in the project make use of all communication channels offered by the Internet (e-mail, Bulletin Board, videoconference).
  For the conduct of the research, the analysis and presentation of the results an innovative web-enabled software has been developed in the framework of the project that has the form of an interactive web page. This software allows the input and analysis of data in real time. The students-"journalists" enter the data that they collect with the questionnaires into a web database. The software has the capability of analysing and displaying the results with the instant generation of multidynamic plots. The students-"journalists" have therefore the possibility of observing directly how their entries affect the statistics of the research. The statistical results can be viewed in the form of a histogram or a pie chart and inspected by everyone who visits the project's site. The students using the web enabled software become familiar with data analysis and data presentation in plots as a function of the sample's parameters (age, sex, country).
  In the development of the electronic tool special care is given to its user friendliness and its attractiveness. The electronic tool with the real time analysis and display of data offers new possibilities and stimulation in discussing important social issues in the framework of courses such Civic Education, Informatics, Economics, Religion and History.

5. An integrated strategy for the school of tomorrow - Front-end technologies in Education – The Lab of Tomorrow project

Both the power and the problem with modern scientific instruments used in the school laboratories are reflected in the term "black box" that is commonly used to describe the equipment. Today's black-box instruments are highly effective in allowing students to make measurements and collect data - enabling even novices to perform advanced scientific experiments based in most of the cases on advanced simulations. But at the same time, these black boxes are "opaque" as their inner workings are often hidden and thus poorly understood by the users. Furthermore they are bland in appearance making it difficult for students to feel a sense of personal connection with scientific activity. "To many students a lab means manipulating equipment and not manipulating ideas" [10]. Electronics and computational technologies have accelerated this trend, filling science laboratories and classrooms with ever more opaque black boxes.

Paradoxically, the same electronics technologies that have contributed to the black-boxing of science can also be used to reintroduce a vigorously creative and aesthetic dimension into the design of scientific instrumentation - particularly in the context of science education.

In the above context Ellinogermaniki Agogi in collaboration with 10 European Institutions has proposed the **Lab of Tomorrow** project, approved in the framework of IST programme – "School of Tomorrow" Action Line. The project will introduce innovation both in pedagogy and technology. It aims at developing tools that will allow for as many links of teaching of natural sciences as possible with every day life. It will allow the student to link i.e. physics with "physis" (Greek word for nature), biology with

"bios" (Greek word for life) and so on. The Lab of Tomorrow project will develop a new learning scheme by introducing a technologically advanced approach for teaching science through every day activities. Science deals with the study of nature and the world around us, so teaching science cannot be separated from daily experiences resulting from student's interaction with the physical phenomena. The connection of tangible phenomena and problems provides students with the ability to apply science everywhere and not only in specially designed experiments under the laboratory's controlled conditions [11].

In the Lab of Tomorrow project the re-engineering of the school lab of tomorrow is proposed by developing a new learning scheme based on the production of computational tools and project materials that allow high-school students to use their every day life environment as the field where they will conduct sophisticated experiments experiencing the applicability of the theoretical background given at school. The **Lab of Tomorrow** [12] project proposes an innovation in pedagogy and technology aiming at the improvement of quality and accessibility of learning through embedded ICT. Emphasis will be given throughout the project to ethical considerations, a crucial parameter for the successful implementation of ICT in school praxis.

In the framework of the Lab of Tomorrow project students' daily activities will give input for learning and create an **omnipresent** learning environment for science teaching, based on a constructionist approach. The goal is to shift away from classroom learning to "daylong" learning. A series of artefacts, the *axions* will be used to facilitate that shift. As the axions will be embedded to everyday objects (cloths, toys, furniture), they will give students the possibility of actively participate in the creation of this environment and therefore achieving the maximum degree of **learning through ICT.** The axions will be able to control sensors, communicate with one another and send the collected data on-line to a database through an advanced communication system. A specially developed graphical user-interface will also be used for data download (transfer from the axions and the wearables to the PC), analysis and presentation in a platform designed to allow for extraction of educationally meaningful conclusions. The main emphasis on the user interface is on the improvement of the interaction between students and the universe of digital services. By using axions and wearables to study the physical phenomena taking place during their daily activities and designing and implementing their own scientific experiments, students will be able to engage in more meaningful and motivating science-inquiry activities.

The proposed project will help both teachers and students become familiar with new technologies and innovative educational approaches. Specially students will have the opportunity not only to see but also to use new advanced technologies, with which they will be confronted as future citizens, in an increasing number of sectors in every day life (health, communications, m-commerce). The potential that technology offers in the proposed task of "project assignment" will enhance their creativity through **teamwork** and a **problem solving** orientation. Axions and wearables will serve as spurs to the imagination, prompting to see all kinds of daily activities as possible subjects of both formal and informal scientific investigation. The partnership believes that students can come to view the development of their own experiments and projects based on their activities as a craft that rewards dedication and precision but simultaneously encourages a spirit of creativity, exuberance, humour, stylishness and personal expression.

6. Conclusions

Globalisation with its impact on society and economy certainly asks for educational tools that allow international contacts and experiences already at school level. Although it is evident that changes in attitudes and skills are taking place, without careful and precise evaluations one cannot predict the exact kind of changes. This information is not only essential for gaining a better understanding of psychological and social processes, but it also provides guidelines for the development of well designed pedagogical frameworks for ODL's implementation in the educational praxis. In the presented studies educational tools that serve this objective to a high degree have been developed and applied in real school environments around Europe. The implementation of the projects has proven that the Internet tools and especially ODL can be considered as very promising tools that help in accomplishing these objectives.

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SPECIFICATION OF PLATFORMS FOR DISTANCE LEARNING

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Introduction

The use of the media and new technologies in education has been for many years an active domain of research and experimentation. The choice of the Internet and in particular the World Wide Web highlights the reality of the virtual campus. Neologisms like "cyber-campus", "e-book", "electronic wallet" become casual vocabulary. On-Line Learning revolutionises the way of distributing information and knowledge. Courseware Engineering or Educational Engineering acquires a formal status of nobility. Teachers and their institutions discover a large palette of tools in order to design, prototype, realise and maintain learning environments, especially virtual distance learning environments. These applications embed methodology, multimedia information, collaboration and management tools which allow the realisation of a distance learning environment.

This kind of environment thoroughly modifies the learner's and teacher's skills. New modes of knowledge management arise. The teacher becomes a knowledge guide. He produces multimedia resources, he conducts on-line teaching, he makes the learners collaborate. The learner is no longer a knowledge consumer, but, becomes himself a producer.

In order to organise efficiently knowledge, methodologies and tools have to allow the development of an "open learning environment". All the actors involved in the learning process must be active. We have to go forward by creating learning communities. Using these tools, to collaborate and communicate becomes very simple. It remains to collaborate and communicate the objectives.

In this article, we present our project on a MOO-based distance learning environment. In a fist part, we discuss about the MOOs environments and the architecture of our platform. Then, outlined by our analyse and use of this environment, we present the main pedagogical objects offered to an designer. We think that MOOs environments are adapted for the design of Cooperative Information Systems. We show our approach in a third part.

1. A MOO-based virtual distance learning environment

Multi-user Object Oriented environments (MOO's) developed originally by Xerox Palto Alto Research Center, have been available for some years and are only recently entering into the area of online education. Designed as a venue for online community creation, we are sure that MOO's are well-suited to use by educators to create an online learning environment.

1.1. What's MOO and WebMOO

MOOs evolved from MUDs (Multi-User Domains). A MOO is a virtual space on the internet The first of these was developed at the famous Xerox PARC (Palo Alto Research Center) by Pavel Curtis (1), and is known as LambdaMOO. Since the public domain release of the MOO server code and its subsequent porting to various operating systems, MOOs have become a vastly popular form of communication and learning. They serve a variety of functions, both social and educational, and are not simply games. Today, many educational MOO are implemented, for example, LinguaMOO (http://lingua.utdallas.edu:7000/), TecfaMOO (http://tecfa.unige.ch/campus/infospace/index.php), AussieMOO (silo.riv.csu.edu.au 7777), BioMOO (http://bioinfo.weizmann.ac.il:8888/), Esc-Pau MOO (http://moo.esc-pau.fr:7000/), MediaMOO (mediamoo.media.mit.edu 8888) and so on.
Sometimes the MOO is used to improve programming skills - the MOO server code has a built-in programming language for developing objects and verbs (commands) in the virtual reality interface and making them interactive and interesting. The language is a combination of C and LISP, but it is its own language altogether in some respects.

Recently, MOOs went on the Web. This allows people to access the MOO through their Web server, rather than through a program such as telnet. By moving a MOO to the Web, we can easily access to multimedia information.
According to R. Rein (2), there are three basic ways of joining MOOs and the Web.
There is

- MOO to Web, which is connecting to the Web from a MOO.
- The flip side is Web to MOO, which is using the MOO to serve information on the Web.
- However, the most promising is the WOO (Web-MOO), which uses a Web client to access a MOO and allows the use of HTML and HTTP to include multimedia (sound and graphics) aspects to the MOO experience.

1.2. Our experimentation on the MOO

We have implemented a virtual environment to support online education for management students. This environment, which is implemented using multi-user domain (MUD) and enCoreXpress technology on our Linux and Apache server, simulates a virtual campus. In this environment, many tools are available.

1.2.1. The Architecture

The enCore project was started by Jan Rune Holmevik and Cynthia Haynes in 1997. It was designed to promote and develop the use of MOO technology in education. The central component of the project is the enCore Educational MOO Database. Version 2.0 of enCore comes with Xpress which is a new graphical user interface that is specifically designed to make enCore-based MOOs easier to use for new and inexperienced users. It implements a point and click interface that makes MOO mailing, editing, programming and object creation and much, much more easy and hassle free. Among other features introduced in Xpress are context sensitive help, automatic detection of URLs in texts and descriptions, support for sounds and other multimedia content, collaborative web surfing and more.

Since enCore Xpress is a web-based client system, anyone with an up-to-date web browser such as the latest versions of Netscape Communicator or Microsoft Internet Explorer can use it without having to download special MOO client Programs.

The enCore Xpress is a new web-based MOO client that brings a feature-rich, and graphically enhanced hypertextual interface to the MOO experience. It is a truly platform-independent system that brings together the power of MOO, HTML, Java and JavaScript in one easy to use application. enCore Xpress resides remotely on the MOO server, and the end-user runs it in his web browser, thus, there is nothing to download or install for the end-user.

The enCore Xpress client window has three areas (Annex 1). On top is the menu area with buttons for various MOO applications such as the Help Browser, the Who Browser, the Mail Browser and Editor and so forth. This menu line is generated based on the player class the end-user belongs to. Thus, if the end-user is a builder, he will see buttons for applications that are relevant to all players and builders, but not to programmers and wizards. To the left is the chat area where text that the end-user and others type is displayed. This area has two separate fields, one where the end-user type in text (bottom), and one where the MOO displays text.

The area to the right of the enCore Xpress window is the hypertext output area. This is where the MOO will display descriptions of rooms, players, and other objects that you explore.

1.2.2. Different levels of use

There are a number of levels available to players :

- Guest -the base level -
- Player - the next level - players must select a character based on the MOO theme

- Builder - Available after 1 month of activity as a player. Builders must have a character name based on the MOO theme
- Programmer - Available only upon application and having good standing as a builder.
- Wizard : the MOO administrator

All of these characters are instances of the player object (Figure 2). The Wizard owns all the methods. When learners and teachers connect to the MOO, they do it via a specially created character that is individually customisable. They are represented by that character in a virtual environment in which they can participate and collaborate. In our MOO, all the teachers got the programmer character and all the learners the Builder character.

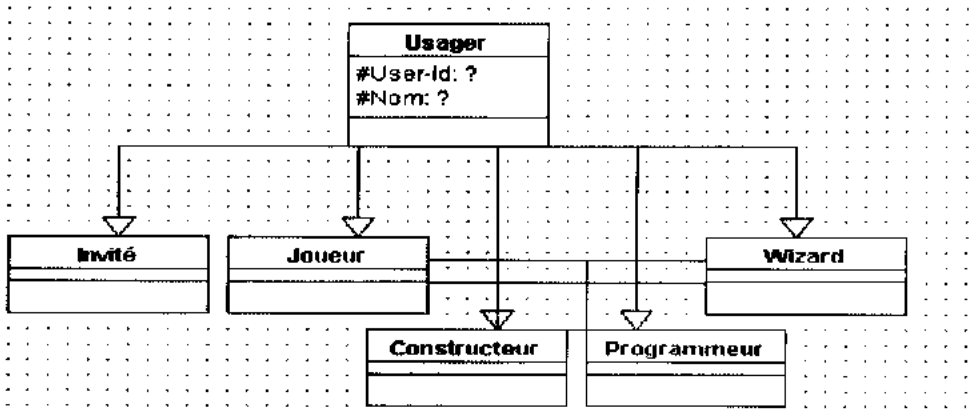

Figure 2 : An OMT Model for the users

Let's discuss in the second part about the main educational objects in such a platform.

2. Educational objects on the UPPA-MOO

MOOs allow for individual users to extend the environment both programmatically, and by "building" or creating new objects. In an educational context, this can allow the student to become an active participant in the learning experience. But in a first step, the online modules has to be created by teachers. They can use or instantiate educational objects within the MOO environment. Thanks to the Web interface, this work can be done in a convivial way.

2.1. The Web-MOO

We can distinguish several levels of WWW Use in Education. In order of difficulty they are :

1. The Web as information tool: Curricula and courses information, etc.
2. Distribution of learning material: E.g. books (in various formats like postscript, word-processor, etc.), programs, applications needing a specific interpreter/language for the client
3. Collaboration tools
4. Interactive educational applications:

The realisation of level 3 and level 4 WWW-interfaced applications are hindered both by the design of the WWW and the fact that advanced programming knowledge is required.

Recently a few interesting new developments can be observed in the WWW world, like: HotJava (a WWW client that can execute programs), WWW-MOO interfaces, VRML (virtual reality mark-up language) interfaces, Netscape's "server-pushes", Educational packages for CGI-scripts. These extensions and additions will add additional power to the WWW and increase its popularity.

One of the most exciting recent developments for education are WWW interfaces to MOOs, a variant of text-based virtual worlds. ``A MOO is a network-accessible, multi-user, programmable, interactive system well-suited to the construction of text-based adventure games, conferencing systems, and other collaborative software. Its most common use, however, is as a multi-participant, low-bandwidth virtual reality" Participants (usually referred to as "players") connect to LambdaMOO using Telnet or some other, more specialised, "client" program. Having connected to a character, players then give one-line commands that are parsed and interpreted by LambdaMOO as appropriate. Such commands may cause changes in the virtual reality, such as the location of a character, or may simply report on the current state of that reality, such as the appearance of some object.

[....] The job of interpreting those commands is shared between the two major components in the LambdaMOO system: the "server" and the "database". The server is a program, written in a standard programming language, that manages the network connections, maintains queues of commands and other tasks to be executed, controls all access to the database, and executes other programs written in the MOO programming language. The database contains representations of all of the objects in the virtual reality, including the MOO programs that the server executes to give those objects their specific behaviours." (Curtis 93)

A MOO server can also be configured to act as an HTTP server. This means that a WWW browser can be used to look at locations, rooms, people, artefacts, etc. in the MOO. Those objects can have hypertext (URL's) attached and therefore be used to structure information on the Web. These extends are comfortable to create an educational use of a MOO.

2.2. Relevant objects to design an online course (Authoring tools to design courses)

With the status of programmer, the teacher may design many things to interact with his (her) learners. In this paragraph, we discuss about some relevant objects. We have implemented some of them in our MOO (Annex 2).

1. Public Writable Note
   To Write on the note, the end-user uses the chat window and he can write the number of sentences desired. The main strength of this object is that its allows collaboration. Everybody can write on this note. Then, the MOO becomes more attractive. The owner of this object can decide if the "writers" can be anonymous or not by the is very basic (only copy&past). The generic WebPage is more attractive but the end-user has to know HTML command "set objectname.anonymous to 0"
   Methods associated to this object are the same than a note.

2. Slide Projector
   Allows to view ten slides on the screen. Each slide can contain 22 lines. This pedagogical object is interesting to present a curriculum subdivised into chapters. It allows a public presentation of the document ("show" command) or a private one ("review" command)
   The main inconvenient is based on the enCore text-editor which code.

3. Recorder and player
   This educational object allows to record and play all the conversations that appear in the same room than the end-user. It's a very good tool for pedagogical objectives. The recorder can be mailed to the owner of the room (in fact, the teacher). We can use this object to keep a trace of student's answers. For example, we have implemented a robot which is able to question the learners. Answers are recorded and mailed to the teacher. He can easily analyse the work of the students.
   We are looking in the use of this object for the security aspect. We want to put on the UPPA-MOO a forum for the students : a room for meeting end information exchanges. Thanks to a recorder, we would supervise the students work

4. Bot
   With this bot, we can plan a pedagogical talk.
   For example, we implement this kind of object to guide a new learner on the MOO. It's an Elisa-like Bot. Difficulties are in the apprenticeship of the different words. We can use this kind of object to do tutorials for the main commands of the MOO programming language or for the running of a precise object.

Finally, we can program it to test the knowledge gained by the students in a particular module. In fact, the teacher has to plan growing levels of difficulties. The recorder of the conversation could allow to evaluate the learner performance.

```
Example of a conversation with a Robot
marie-noelle activates test_robot.
test_robot says, "Gee thanks for waking me up!
I must have dozed off.."
You say, "hi"
test_robot [to marie-noelle]: Hi, how are you?
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5. The Web Projector
   This object allows to give to the learners predefined URL's Web sites. Slides are Web sites. The Web projector is very useful to orient the members of the MOO for information research. It's very easy to implement this kind of object.
   The associated commands allow to display the Web pages to everybody, only to particular students.

6. Generic Lecture
   Thos object can be shared and edited by numerous people. It's very useful to write a lesson between two people.
   On the different MOO , the more used room is the forum or the conference room. Thanks to the generic lecture object, the teacher can plan the course and give to the students when he wants. It exists some commands to 'deliver the lecture', to 'pause the lecture', to 'resume the lecture', to adjust pauses, to give the lecture line by line,...

7. Generic Emissary Object
   Thanks to this object the teacher can create a clone. So, the interactivity of a teacher is increased because he can be in two places in the same time. It's very important in the educational online process

8. I.C.E. Tray Storage Parent
   This object shares the specificity of the slide projector and the web projector. In fact , it allows to visualise a web page like a slide with personal annotations. This object is confirmed to be very useful for a teacher who wants to guide the student's research on the Web.

9. The Virtual Assignment Server Environment
   The Virtual Assignment Server Environment (VASE) is a complete online, MOO-based assignment system. With VASE, educators can easily set up assignments for their students to work on online. Students complete and hand in assignments online, making this an ideal distance learning tool within the social learning space of the enCore MOO.

Within a MOO environment, all theses objects can be used normally. We are working now on the specification of different methods applied to some of them.

3. Cooperation of learner's and teacher's Information Systems

The most interesting way of MOO is that all participants in a MOO can create their own learning spaces and decide to share them with peers. The approach emphasises learning by doing and by collaborative learning. The learner's Information System is in constant evolution.

The environment facilitates asynchronous access, the teacher can give an access to information sources. The Web projector Object allows to design an educational object which includes different URLs in a specified domain. A bulletin board can be used by students to post questions (they will be answered by en expert) ; the mail system and online documents are also available to do a synchronised communication.

They are different manners to improve the IS and to make Cooperative IS : communication with experts, collaborative learning (with the presence of an expert), individual learning.

In order to provide the desired piece of information to the learner, it is necessary for the teacher to adapt to the learner's needs and the learner's current state of knowledge.

Cooperative Information System are the main support for the building of knowledge. We have to take into account the cooperation between two classes of agents : students and teachers. In this kind of relationship, the cooperation could be:

- classic : to transmit information which the teacher have
- complex : the other way is to keep a part of activities of an other agent.
  CIS will change our mind of teaching and learning. The intensive use of the MOOs environment will give us some answers.

Conclusion

To improve our experience with the MOO environment, we are working on two projects :

- the most important is the design of an online diploma : the DESS CAAE. This training of third cycle is in the area of management. About 15 masters are proposed.
- The other one is to manage with the MOO a group of project Students involved in this project are computer scientist. The objective is to design and implement particular educational objects based on Java code.

We are convinced that the MOO environment has to be improved by design tools. Teachers manipulate pedagogical and didactical concepts. These concepts have to be automatically translated into MOO objects.

Furthermore, on the basis of our experiments on two different technological platforms, we will try to highlight a methodology in which to design "open distance learning environments".

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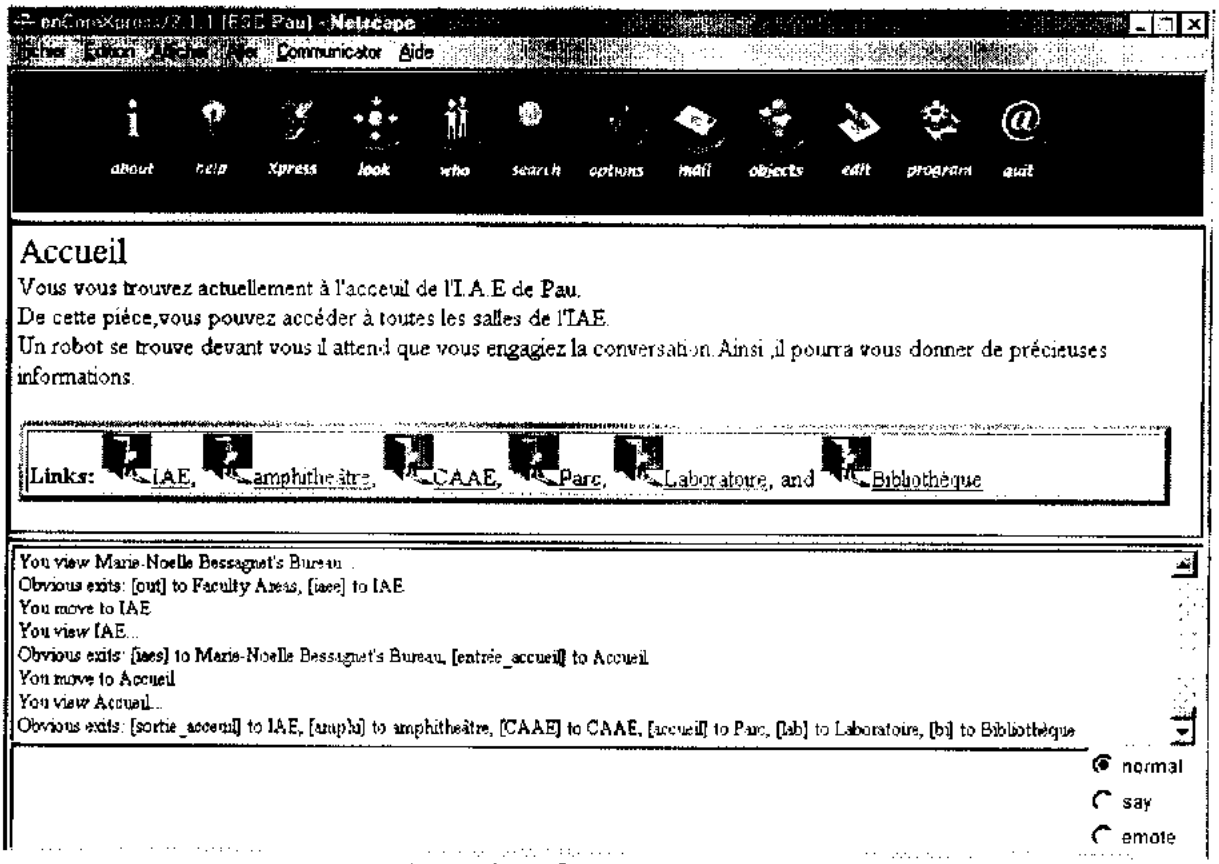
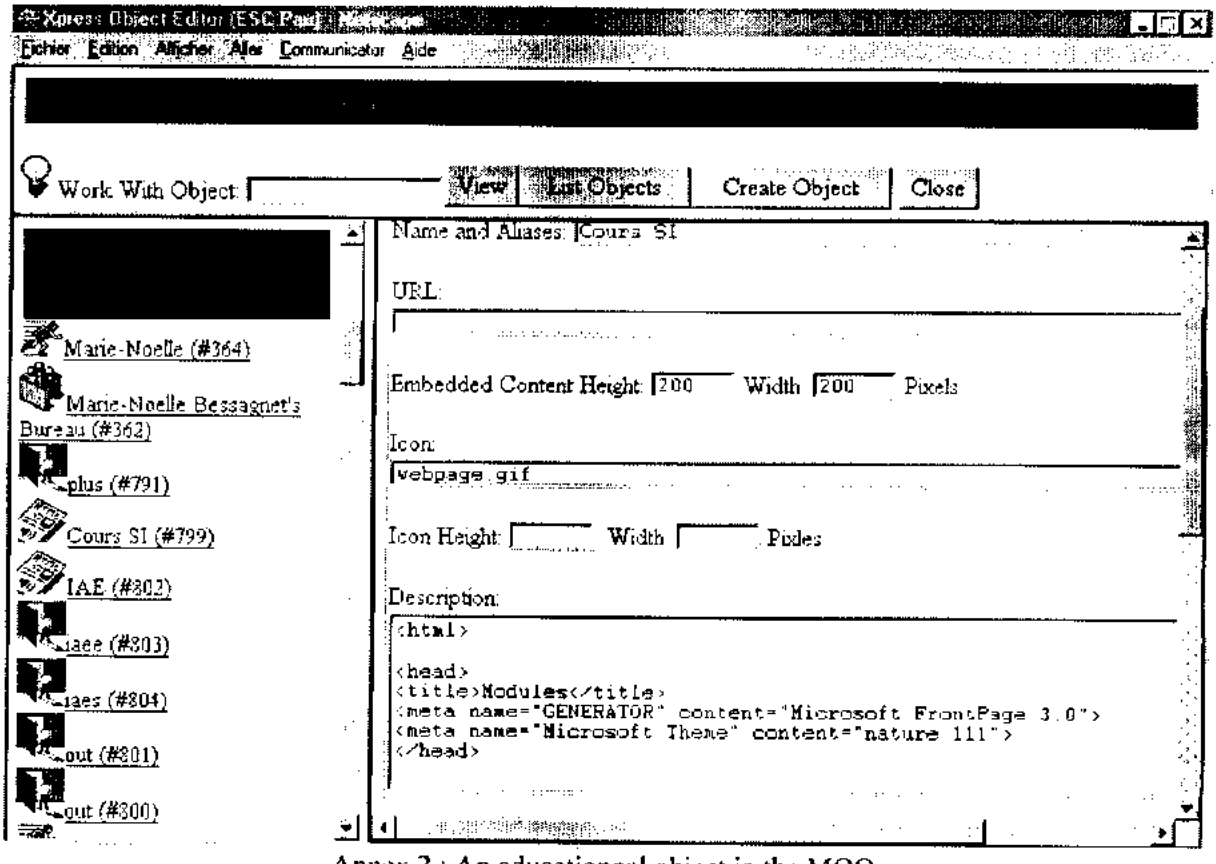


Annex 1 : enCore Xpress Interface



Annex 2 : An educationnal object in the MOO

FUTURE DEVELOPMENTS IN SCHOOLS

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The quick development of information and communication technology raises many questions. What will be the main features of the school of tomorrow ? How will change the many functions which are currently undertaken by the schools. Some prophets are assuming that the school – as we know it today – will not exist any more in the future. They claim that home learning systems will replace school education, leaving more time for games and alternative places for learning, for socialising and for personal development.

One important feature I would like to outline, when looking at the future, is the importance of having places for group communication, social interaction and dialogue, within the school.

The adaptation of the school will probably be linked to the improvement of its role, as a place of communication.
A very large survey took place in France some years ago, to better identify the needs and expectations of pupils (from 13 to 17) about the education system. More than 60% of the interviewees claimed that there was a lack of communication facilities. Most of the more innovative school experiences took place thanks to the commitment of small groups of teachers, which had strong communication links among themselves, and had good communication channels with networks outside school. The computer laboratory itself has become, in many schools, a communication place. Pupils are given the opportunity of exchanging information with other teachers, tutors, and with pupils from other levels. Such environments – where face-to-face contacts are made - provide new learning opportunities which considerably enrich the learner/teacher dialogue.

The school also has an important role as a provider of books, videos, science laboratories and computers. The telephone charges decrease in price will allow schools to get additional telephone facilities, something they have not benefitted from in the past, except perhaps in the Headteacher's office. The material will evolve in such a way that technical provisions will, on average, be of a higher standard than the ones that are available at home.

The future role of the school may result in a greater involvement of people from outside the school. Parents, experts, local authorities, businesses and museums will be more involved than they were in the past.
Technology will have to serve the educational purpose. It should not be the other way round. Then, how will technical resources be organised to fulfill the needs of the school?
How, in particular, will the school architecture evolve in order to fulfil the communication functions which may be a main features of the classrooms of tomorrow?

I would like to elaborate on different models which could be the design models for communication between pupils and external resources: the library model, the television model, the internet café model, the 'greek agora' model. Each model may involve a mix of virtual and real elements. They may be combined together. New places have to be designed, providing access to available resources: books, videos, synchronous videoconferences, peers, experts, etc.
Each model may involve mixed modes of communication: direct or mediated communication.

Who will be responsible for designing these resources.
Will they be designed at local, or at regional, national, international level?

For example, taking television as an example, the television function could be fulfilled by encouraging pupils to produce their own daily community broadcast news magazine. They would use light numeric cameras in order to do interviews in the local area nearby the school, and be trained to manipulate and build images.

If designed at a national or international level, it would mostly connect available resources and audiovisual archives from television channels. Thes could then be made accessible by downloading through broadband networks.
Both may exist – obviously – but different places or different architectural arrangements will be required in order to allow the two options to take place.
It will be possible to have a cinema projection room within the classroom, at prices which have not yet been affordable so far. Such rooms may also support synchronous video conferences, then raising the issue of their optimal size, and the related issue of variable geometry, to comply with different size of groups for group discussions.
Development in technologies will also lead us to revising our concept of using video-based documents. There will be a range of resources, from films and 'story telling' documentaires to video clips, which will be accessible through the web.
The whole notion of public access – whithin the school - may be changed if it this access may also becomes synonimous of public communication, group communication, collaborative production.

Another range of resources may be much more accessible to pupils in the classrooms: the ones which relate to games: science games, simulations.
Up to now, many of these resources have been available as software, but we must foresee the development of new tools like the LOGO turtle, or specific robots, which may be aimed at pupils.
Specific devices are designed by science museums in order to explain some scientific concepts or in order to demonstrate such or such phenomenon. Should we call them robots? Where will these new objects be stored?
Will there be "game libraries", aimed at edutainment, within the school? Will the libraries extend to these functions, across the traditional science laboratory and the playground?

To come back to the "communication" issue, I wish to conclude on the broader impact of technology as a catalyst for communication and for social interaction.
Communication technologies are indeed aimed – by definition – at communicating.
But this does not apply only to remote communication. As it has been demonstrated that the greater availability of the telephone has boosted physical mobility, it may also be demonstrated that technology could be a leverage to restoring the social link, locally. Around the current notions of communities of practice, communities of interest and learning communities, is raised the question of "the social link" not only within the school, but within the broader territory where it is located, within regions, towns or villages.

If this hypothesis is valid, we must design or redesign communication places within schools to allow this dimension to happen. We have to work more in the field of social engineering, and see how technology may foster it. We have to become more professionnal in the way we handle group discussions, group works, and how we use social interaction as a stimulus for learning.
Any inputs along these lines of ideas are welcome.

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AN INVESTIGATION OF TEACHERS' USE OF IMS SOFTWARE IN IRISH SECOND LEVEL SCHOOLS: A CASE STUDY

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Introduction

This study investigates teachers' use of a particular type of web based software known as TopClass. The research focuses on the issues affecting the teachers' use of the software in Irish post-primary education. The paper is divided into four sections. The first section traces the use of computers in Irish post-primary education and also outlines the *Schools IT2000* initiative currently being implemented in schools across the state. This section also contains a brief description of the software used in the study and the rationale for its use. Section two describes the research methodology used in the study.
Section three presents the findings of the research. This section is followed by the discussion and conclusions section, which raises several issues arising from the research.

Section 1: Background to the study

There has been limited educational use of computers in Irish post-primary education. The earliest recognised use of the computer was with the introduction of an optional module in Leaving Certificate Mathematics syllabus in 1980. Being an optional module it did not have any notable impact on computer use in post-primary schools. However, throughout the 1980s as the computer became widely used in business and industry, post-primary syllabi changed to reflect this. During this decade computer modules were offered in Junior Certificate Business Studies, Metalwork, Technical Graphics and Leaving Certificate Engineering. As outlined in the relevant syllabi below;

> The advance of new technology has already reached the stage where all students should be given some experience in its operation. Business studies makes provision for basic keyboarding training, it also advocates the use of the skill in operating appropriate software ... To develop the skill of accurate keyboarding. (Junior Certificate, Business Studies Syllabus, p. 2 - 3)

> [students will be able to] produce computer generated drawings and graphical solutions using appropriate computer graphics and computer-aided design software (Dept. of Education - Junior Certificate Technical Graphics syllabus, p.6)

This vocational focus remained until the late 1990's as highlighted in studies by Drury (1995) and Mulkeen (1997). This trend was recognised by the Department of Education and Science in 1996;

> the fact that most usage of IT in post-primary schools occurs in informatics (i.e. classes timetabled as "computer studies" or similar) rather than in other subject areas, means that most study is **of** (emphasised in original) rather than **with** the technology. (Dept. of Education and Science, 1996)

To address these low levels of use across the curriculum at post primary level the *Schools IT2000* initiative was launched in 1997. Its core objectives are to put in place a permanent infrastructure that will ensure that pupils in every school have the opportunity to achieve computer literacy and to equip themselves for participation in the information society. It also aims to support teachers in developing and renewing their professional skills, which will enable them to utilise ICT as part of the learning environment of the school (Schools IT2000).

Schools in Ireland, however, were not greatly influenced by the first wave of interest in the educational use of the computer and therefore had little prior experience of the use of the computer across the curriculum. Schools and teachers are now faced with several challenges attempting to implement the computer into their classes. Issues such as the suitability of software, teachers' IT skills, time required to search and evaluate appropriate material and issues of online security prevent many teachers from considering the web as an educational resource. In light of this fact there is an increasing need to develop software which addresses these problems. This study investigated the use of IMS software (namely TopClass) in addressing the above issues faced by teachers.

IMS software is software designed to display highly interactive material on the web in a closed and safe environment. It also facilitates online discussion and interaction.
The use of this type of software as a teaching/learning tool across the curriculum has the potential to;

- Create a safe and controlled on-line learning environment where pupils can visit relevant educational sites, use discussion groups and send and receive email without external intervention from unknown users;
- Promote collaboration among pupils using the collaboration tools and facilitate student-centred learning while developing IT skills;
- Display material relevant to specific classes since the course content is designed, created and managed by the class-teacher and therefore is specifically suited to the pupils using the system;
- Continuously monitor pupil progress using the testing and administration features of the system.

Unlike other types of software used for educational purposes, the teacher has complete control over the content of TopClass. An effective TopClass course is therefore dependent on the quality of the material content placed into the system and the effective management of the learning environment by the teacher. Therefore the teacher must possess the ability to effectively utilise the collaboration tools to promote active student centred learning and to increase collaboration among pupils.

Objectives of the Case Study

The purpose of this case study was to investigate teachers' use of IMS software in selected post primary schools and also to assess the feasibility of using this type of software in post-primary education generally.
Since the use and management of the software by the teacher is the key to the success of a TopClass course particular emphasis was placed on the teachers' ability to manage the learning environment using the software features available on TopClass.

Section 2: Research Methodology

Location of the Study

The schools selected for the study were situated a large town. It was a unique town as it had the status of information age town. All schools had large numbers of IT resources and all homes in the town and surrounding areas had IT access. These schools were therefore ideally equipped to utilise web based IMS software. In addition to the schools' level of hardware because a high proportion of pupils attending the school had home-access to the Internet they had the ability to access course material from home to complete assignments. This also allowed students to interact and collaborate with their peers from outside of the school.

Selection of teachers

All teachers from four second-level schools in the town were invited to participate in the study. Since the uptake of the study was voluntary it was acknowledged that teachers with an interest in the use of computers and ICT in education would be attracted to this study.

Research instruments

The research carried out in this case study was qualitative and exploratory in nature. Three sources of data were used to gather information on the teachers' use of the TopClass software.
Data was obtained by monitoring teachers' ongoing use of the course design, administration - management and collaboration tools of the TopClass software. This use was recorded over a four-month period using the management and administration tools built into the TopClass software which automatically logs all use of TopClass.

The amount of logged entries into TopClass and the teachers' use of all features of TopClass were recorded, these included;

- frequency and type of use of course editing tools to edit course content placed on the server and their use of additional course creation tools such as course uploading, reordering etc.
- amount and type of use of the collaboration tools such as their use of email, their use of the announcement features and discussion groups.
- amount and type of use of the management and administration tools such as test creation and editing, review of submissions, monitoring pupils progress etc.

It was initially envisaged that the teachers' ability to create courses in TopClass would be the primary focus of the research however on commencement of the study it became apparent that the initial workload required to create TopClass courses was too demanding for a practicing teacher in the time scale of the study. Course content was therefore created by the researcher in collaboration with the teachers and placed online. Once online, the course content was accessible to teachers allowing them to edit and modify its content. As teachers did not create the course content, the focus shifted to assessing how effectively the teachers' utilised the available tools. This involved assessing the teachers' ability to manage the learning environment and their use of collaboration tools.
Particular attention was paid to how the teachers guided discussion groups and how they used the announcement facility by observing their input into the system. Assessment of their use of the collaboration and communication tools focused on whether they used the tools in a collaborative or didactic manner.

Teacher Interviews

Teachers were interviewed at the close of the school year using semi-structured type interviews. Although the interview was the primary source of data collected it was essential that the statements made by teachers in the interviews were compared to their recorded use of the software. To ensure validity two other sources of data were used to compare the teachers' comments with their actual use of the system. The statistical data obtained by the IMS administration tools and the researchers' observations of the teachers' use of the software during the study were compared with the teachers' statements. This method of triangulation was used to ensure the validity of teachers' statements.

Section 3: Research Findings

The study found that schools use of their computer resources continued to focus on vocational training in subjects such as Computer Studies, Technical Graphics and Business Studies. Although the schools had received recent investments in computer hardware there was limited use of these resources by teachers. Most computer use by pupils was extra-curricular project work. The computer was also primarily used for word processing. In general the schools had not altered their use of the computer to any great extent since the investment in new technology.

Teachers' decisions to use the software

Teachers had decided to use the software for three reasons;

They had an interest in IT and wanted to assess the potential of the software.

1. Being the computer teachers in the school they were also expected to partake in such initiatives.
2. They were currently evaluating subject relevant educational software and decided to assess the potential of TopClass.

However from teachers' comments during interviews it was evident that in their positions as IT teachers within their respective schools they were expected to participate in the study by the school principal and other staff members. This is evident from an interview response from teacher A:

"There wouldn't be great enthusiasm [Among other teaching staff] ... a lot of the other teachers wouldn't have felt comfortable doing it. When we were approached I knew somebody in the school was going to have to do it. I put it to everybody most of them felt they wouldn't have the computer skills to do it so I said I'd do it myself, and I'm interested ... I was the only volunteer" (Teacher A interview 17 May 1999)

Teachers use of the software during the study

Use of the software was greatly affected by hardware problems in both schools. The ISDN line used by the school could not support in excess of 20 simultaneous users. This was a very surprising finding as the schools selected had state of the art computers with much higher specifications than the vast majority of other schools in the state.

Teachers did not experiment with the software and depended on advice and guidance from the researcher and in general did not use the software in any innovative way. One teacher (Teacher A) used the software to promote student centred learning by initiating discussions and group tasks however the other teachers (Teachers B and C) tended to use the software in a very didactic manner. These teachers did not use the discussion tools and only used the announcements on the software to inform students of homework that had to be completed as highlighted from the two examples below;

"revise the page on blood vessels and the page on arteries and veins.then do the test at the end of this page and submit it to me." (Class announcement by teacher B 14/ 5/ 99 10:11)

"keep revising" (Class announcement by teacher C 14/ 5/ 99 9:33)

The teachers that participated in the study felt that TopClass was only suited for non-Leaving Certificate classes[1]. This highlights the exam driven culture of second level schools where innovate teaching and learning is limited to classes that are not affected by state examinations. This was best summed up by teacher C who stated
"the exam classes they really just don't have the time to be playing with computers".
Teacher A stated;

"College places, they just don't have time, competition is too fierce to get into college." (Teacher A interview 17 May 1999)

The teachers that participated felt that other teachers did not participate for a number of reasons. Teacher A believed that teachers' fear of computers, especially their lack of confidence in their abilities to use the computer, were the most important factors.

"There afraid about the computers.... they didn't think they'd have enough computer knowledge" (Teacher A interview 17 May 1999)

Other teachers (B and C) felt that felt that other teachers did not participate in the study since it was reserved for the computer teachers in the school and they would not be given the same privileges as the computer teachers within the school.

Section 4: Conclusions

Use of ICTs in second-level education

This study has highlighted two main issues. It firstly highlights the oganisational barriers affecting teachers' use of ICT in an innovative way. Other observers in this area have also raised this issue;

It remains to be seen whether the Irish education system, especially in terms of its existing curriculum and pedagogy, is really capable of absorbing the rapid rate of technological change in its midst. (Malone, 1998, p. 162)

For the computer to be used in an innovative way, which allows collaboration, an environment must firstly be in place that promotes and facilitates its use. Unless the organisation in which the computer is being implemented can facilitate change its use will not be considered since the implementation will be

[1] The Leaving Certificate is a state exam which determines entry into third level. Students study for two years generally fromthe age of 16 to 18.

impractical. Factors effecting teachers use of the software during the study indicate that the Irish second level educational system does not have an environment that encourages teachers to experiment with the computer as a teaching/learning tool. There are two main factors that inhibit its use. Firstly the demand for third level positions has increased in the past 15 years. This demand has permeated into second-level schools and has resulted in schools placing a greater emphasis on state examinations that determine entry into third-level. Schools have become increasingly competitive and focused mainly on academic performance with an emphasis on the 'product and not the process'. When asked what was preventing the use of ICT across the curriculum in education teacher A stated:

> "CAO and college places they just don't have time competition is too fierce to get into college. Its points at the end of the day that any or most of the kids now I'm not saying that all of the kids but that's the way every Irish school is based. Just get your points to get out get into college, its just the discovery learning, when you see the amount you have to do with a class in two years or three years in junior cert, there's just an amount of stuff to be done you know." (Teacher A interview 17 May 1999)

Which supports Callan (1997) who writes;

> The leaving cert. is ***the*** major concern for teachers. Tasks or activities which are irrelevant to this concern are put to one side. Active learning in Junior certificate classes, for example, is not considered necessary for obtaining a good grasp of subject content, a basic requirement for covering the leaving cert. programme (Callan, 1997, p.24)

Curricula are rigidly adhered to as schools race to cover prescribed course content. The greater importance placed on second-level education has therefore prevented experimental use of new teaching/learning techniques, teaching is "primarily didactic in nature" (OECD, 1991 cited in Callan, 1997, p. 23) and teacher led and classrooms have changed little in layout from those of the ninetieth century. Innovative teaching and learning such as collaborative project work with the use of educational technology are therefore not dominant since schools are focused on academic goals which are best achieved through didactic teaching. The focus on factual content and the preparation for state assessment through didactic teaching styles have caused schools to become closed non-collaborative and competitive and not open to the use of innovative teaching methods. According to Malone (1998) the implementation of ICT into the classroom will therefore be a difficult task;

> "One of the greatest challenges facing Irish education is how to apply the new technology to our curriculum. Considerable research and conclusion needs to take place in the integration of ICT across the curriculum, in all subject areas. Despite the already over-crowded curriculum in our primary and secondary schools, time must be found for the specific discipline of ICT." (Malone, 1998, p. 162)

Secondly the use of computers in second-level schools does not promote their general use. As the literature review has highlighted, computer use has had a vocational focus since its introduction into second-level education. For example, Junior Certificate technical graphics aims to enable pupils to "*produce computer generated drawings and graphical solutions using appropriate computer graphics and computer aided design software*"(Department of Education: Junior Certificate Business studies syllabus. p.3) while business studies, among other objectives, aims to "*develop the skill of accurate keyboarding*"(Department of Education: Junior Certificate Technical Graphical studies syllabus. p.3). These specific computer skills are not as essential as teamwork and collaboration skills that the use of ICT can promote.

Students are generally shown how to work computers using CAD packages and office software (Drury, 1995) rather than shown how to work with computers using the Internet as a resource. This is also due to the closed non-collaborative nature of second level education. All subjects are taught as stand alone subjects with little effort made to relate subject matter to other relevant areas. School timetables are designed according to subject choice and are not developed to provide opportunities where teachers and classes can collaborate, an issue highlighted by Callan (1997);

> A timetable which is constructed around 40 minute class periods is considered inappropriate to realise such activities as project work, field study, and programmes designed to develop research skills. (Callan, 1997, p. 24)

The study has also highlighted the problems faced by teachers when organising an activity that does not fit into the normal routines and procedures of the second-level school timetable. Simply booking and organising the use of the IT facilities in schools can be off-putting for many teachers. Teacher A

highlights the many issues involved in organising the room and the general problems teachers face when they attempt to arrange an activity that does not fit into the normal school routines.

> "It takes an awful lot of time. You don't see the organisation part of it now even just today the amount of people I had to talk to, to organise rooms and to get kids out of classes, swaps with computer teachers there's so much extra, anything extra you do its just so much hassle in a school. Because you have to there's so many levels you have to go through you know people don't want hassle... "(Teacher C interview 19 May 1999)

Since their introduction into second-level schools the computer has been used in a separate 'Computer Studies' subject that also inhibited general use. According to Drury (1995) the majority of school computers are housed in PC labs and are primarily used in Technical Graphics and Business Studies to teach word processing, spreadsheets, CAD and CAM. The study has also shown that these subjects and other courses such as PLC courses, having preference to the IT facilities, can hinder accessibility and prevent teachers using the computer rooms. Therefore teachers wishing to use ICT with a specific class will be restricted by the timetable and also by the compulsory computer subjects such as those in the Leaving Certificate Applied (LCA) and the Post Leabing Certficate (PLC) courses as well as Business Studies and Technical Graphics use.

In summary the entire closed non-collaborative and competitive environment of second-level schools prevents teachers from considering the use of the computer as part of their teaching since its use across the curriculum is impractical in the school. This is due to two reasons; the current climate and focus of second level education and the physical layout of the computer resources in the school. Although teachers may believe that the computer holds enormous potential of greater concern is the exam performance of pupils. The use of ICT that can promote collaboration among pupils and develop greater learner autonomy will therefore not be considered. This can be best summed up by a teacher quote during one of the introductory meetings.
"The system would develop some cognitive skill but in terms of exams it is impractical." (Comment by teacher from School C, 10 March 1999)
This study shows that radical changes are needed in Irish post-primary schools before teachers can seriously consider the use of ICT.

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THE INFLUENCE OF TECHNOLOGY ON EDUCATIONAL INTERACTIONS

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Introduction

Flexibility in learning is based on the capability of carrying through a learning process autonomously. This means being able to choose a method for tackling a problem, re-use competence and experience to face an unknown situation, relate previous knowledge to a new learning objective, try out new strategies, establish collaborative relationships with peers so as to learn from their experience, and so on.
Capacity of this kind is innate in very few students and is difficult to acquire for a number of reasons: it relies on motivation, which strongly depends on personal feelings; it requires self-confidence, the setting of reasonable objectives and of the time needed to reach them, and awareness of one's own learning processes and of the gap between the knowledge already acquired and that to be acquired.
However, continuous evolution of society and changes in the job market demand flexibility in learning from everyone. Accordingly, the scholastic system needs to reconsider its social role and modify its objectives, embracing autonomy in learning besides mastery of knowledge.
To this aim, interaction among the scholastic actors has to be changed. In the present scholastic setting, the learning of a specific content is driven by the teacher: usually, it is s/he who conveys knowledge, i.e. decides the starting point, chooses the strategy to be adopted and the outcomes to be reached. As a consequence, in the majority of situations, the acquisition of knowledge is not accompanied by the learning of the process which leads to the autonomous construction of that knowledge.
These facts suggest that a new scholastic model needs to be built, by rethinking both the objectives and the actors' roles, and by studying methods and tools to implement that model.
ICT (Information Communication Technology) can fulfil a positive function in this renewal process: research in the field gives numerous indications about the potential of ICT as a tool for autonomous learning, and suggests approaches to follow that will allow the education system to exploit this potential [6].
In this paper we will discuss this issue. In particular, we will analyse the influence of ICT on the realisation of educational processes aimed to help teachers modify their role and to assist students to participate actively and creatively in school work. This analysis will be carried out by discussing our experiences with ICT both as a learning subject and as an educational tool.

New role of teachers

The introduction of ICT in schools is modifying the educational contract, as the teacher has to consider technology in some way as a mediator of the educational process. Moreover, ICT increases educational complexity as it modifies the object of teaching and suggests both new approaches to learning and new forms of interaction, thus modifying relationships in the classroom [1].
In the case of learning, computer networking, for example, can play a critical role in helping people to develop collaborative forms. Collaborative learning involves social construction of knowledge and, consequently, new ways of looking at the role of social interactions mediated by the computer [13].
As to interaction, we note that lab activity, which constitutes a central aspect of the use of technology, creates favourable conditions that help educators and learners create a co-working climate, thus modifying their traditional roles [3].
To make the change in the educational setting effective, however, educators have to be trained in how effectively to use new technologies in their work [4]. Training must overcome the view of technology simply as a commodity useful for solving given practical problems [5]. It must also be pointed out that computational environments can be useful tools in the educational process, but learning to use them takes time, and may involve specific pedagogical and epistemological decisions [11]. In the school context, moreover, teachers should be helped to establish links with the industrial world to understand operatively real technology applications [2, 10].

Finally, educators themselves should experiment with the new possibilities offered by ICT to encourage the formation of autonomy ability. In our opinion, this kind of work should be carried out following two different lines:

- Within courses about ICT and its educational uses, devoted to teacher training. As is generally acknowledged, teachers usually teach in the manner in which they themselves were taught, so these kinds of courses can provide an excellent opportunity to get future teachers to carry out activities which allow them to understand how to use ICT in the classroom so as to give students autonomy [6].
- By means of ICT-based training material, devoted to the continuous in-service training of teachers. As is known, competence in learning processes is based on personal experience and on comparison with that of others. Teachers can be helped to develop this kind of experience by means of ICT-based training tools which, rather than giving instruction, guide them to update their educational knowledge of a topic following their own approach to the content, examining it from different points of view, forming a plan to reach an educational objective.

Let us discuss these ideas by means of two examples of implementation: a post-graduate course focusing on *'Multimedia in education'*, devoted to pre-service teachers, and the multimedia system *'The squaring of the circle'*, devoted to the continuous training of in-service teachers.

The 'Multimedia in education' course

In the 1998-1999 academic year the Italian Ministry of Education introduced sweeping reforms in teacher training , setting up a two-year post-graduate specialisation school for the formation of secondary school teachers. The organisation of the specialisation school is entrusted to the universities; the first-year courses started in 1999-2000 only in a limited number of centres, due to the experimental character of the initiative. Within this framework, we ran the *'Multimedia in education'* course at the specialisation school of the University of Genoa.
The course aimed to give trainee teachers the methodological and operative competencies in ICT they would need in order to use multimedia and net-based systems in their future scholastic work. Moreover, the course was designed to help participants understand how ICT can be used to give students autonomous learning capabilities. Table 1 shows the autonomy capabilities we focused on and the activities we organised to make course participants operatively understand how ICT can be used to develop these capabilities.
About 180 participants took part in the course. The results were quite positive, as is shown by the final works presented for evaluation. Moreover, participants showed interest and satisfaction in the course, as shown by the results of a questionnaire and by the group discussions with the tutors. However, they had difficulty accepting autonomy in learning as an element of the final evaluation, making clear the novelty of a scholastic model which sees the learner as being co-responsible for the education process.

Continuous training of mathematics teachers

Another proposal regards the use of multimedia systems for the self-training of in-service teachers. In particular, we were involved in a project, supported by the Italian Ministry of Education, aimed at helping mathematics teachers to change their attitudes towards mathematics teaching. Within this project, a system was developed which deals with topics typically taught in the first years of Italian secondary school, in particular: algebraic problem solving, probability, basic elements of logic, number theory, mathematics and arts, mathematics and the plant world. Each topic is examined from the theoretical and educational point of view. From an educational point of view, for each topic:

- the conceptual difficulties involved are analysed, starting from discussion of paradigmatic problems;
- keys for interpreting those difficulties are proposed, taking into account previous experiments with students;
- questions that should be examined in designing activities to overcome them are suggested, on the basis of the literature on educational research;

- different views of the same topic are shown;
- operative examples of the use of ICT to support the teaching/learning of the topics of interest are indicated.

From a theoretical point of view, the system proposes readings for in-depth examination of the topic, bibliographical references, educational experiences.
The problem of comparing the different interpretations, answering the questions, and relating the activities to classroom teaching is up to the teacher. The system was tested with teachers from the various regions of Italy : the results were encouraging in that the teachers demonstrated interest in tools aimed at stimulating autonomous reflection on teaching rather than in giving teaching models [7].

Capabilities	***Activities***
To become aware that learning strategy depends on both content and on personal learning style	Exchange of e-mail with tutors to explain the learning problems faced, their causes and possible solutions Electronic discussions to identify preferences regarding the approach to the content
To identify personal objectives by becoming aware of personal potential, using personal resources and applying experience to the learning of new content	Development of individual projects, chosen by the participants in the course, focusing on ICT in education, at different level of complexity Discussion on topics of interest to the participants, in the light of the educational opportunities offered by ICT
To self-evaluate mastery of the course topics regarding both the technological content and the educational applicability	Tests on the content Involvement in thematic discussion list on the didactic aspects
To discover learning sources autonomously	Net search
To learn from each other and to compare experiences	(Distance) collaborative work in groups comprising participants with different backgrounds and levels of technological competence
To use personal capabilities to reach a common objective	Complex group projects, which require (distance) management and communication capabilities and involve different kinds of competencies
To learn to be rated by others and to get used to sharing responsibilities	Use of document sharing systems to carry out group activities where responsibilities and tasks are clearly distributed among participants

Table 1. Autonomous learning capabilities and use of ICT

Students as autonomous learners

ICT can be employed to develop students' autonomy in a twofold way: as a learning subject and as a support to the educational process.
As a learning subject, ICT helps to move the control of knowledge from the teacher to the student. It stimulates the intellectual interest of young people; it is motivating, as it constitutes a familiar tool, suggests initiatives and spurs curiosity, as it can be employed to carry out tasks outside the school world, poses new problems, is a continuously evolving field [12]. Moreover, ICT is an applied science, which suggests efficient solutions to traditional problems; finally, students usually control technology better than teachers, thus increasing their self-confidence, awareness of their own capabilities, and sense of usefulness and value of their work.
As a support to the educational process, ICT helps to develop activities which are at the basis of autonomous learning: collaborative work on complex projects, problem solving, hypothesis formation via simulations and comparison of different situations, group discussions, planning of search activities, study of a topic following an individualised learning path, etc [8].
For example, learners can avail themselves of different material (multimedia packages, simulation systems, etc.), so that difficulties can be graded with respect to personal needs, and learners work according to their personal attitude and learning interest. The educator can propose different material on the same topic, and get the learners to choose what material to analyse, in what order, etc., in order to

reach a given objective; this may be solution to a problem, analysis of a situation, or preparation of a report, within a fixed time. This kind of activity can help learners acquire meta-cognitive capabilities, such as that of evaluating difficulties and reasoning about their own learning strategies.
In this respect, it should be noted that the same kind of work cannot easily be carried out using another kind of material such as books, as the stimulus for the activity mainly lies in the kind of material proposed.
Let us discuss these idea by means of three examples: a work experience programme for students and two multimedia systems intended to guide students to develop autonomy capabilities.

Summer work experience courses

For the past four years we have been organising, in collaboration with the A.Gastaldi Technical School in Genoa (Italy), summer work experience courses for ICT technicians. These courses are devoted to helping students get to know the outside world and employ the knowledge acquired in school to the creation of a real product. Moreover, we intend to use this kind of experience to make students aware of the initiative and autonomy capability that the present-day organisation of work requires. To these aims, students are involved in project activities that require collaborative work on research objectives and that thus involve planning, creativity, brainstorming, self evaluation.
This year, for example, we involved students in two projects: one entitled "Multimedialità per la formazione continua nell'industria dell'acqua" within the EC Leonardo da Vinci Programme and the other "Teleconferenza", part of the Adapt Initiative of the European Social Fund. In both cases students participated actively in the work: they took part in the design and realisation of the material, participated in partners' meetings devoted to the scientific discussion of the work, in the planning of future activities, and in evaluation of the activity. This kind of activity and the context involved helped the students to develop a sense of responsibility, to acquire several capabilities: to evaluate the gap between their knowledge and that to be acquired, to evaluate the time needed to reach a given objective, and to collaborate with people of different backgrounds and levels of responsibility.

The multimedia system Looking for Work

Looking for Work is a self-learning tool aimed at orienting people in the activity of job-hunting. The system has been designed and developed within the context of a project supported by the Italian Ministry of Labour and Social Providence. Job hunting is an activity that requires autonomous learning capabilities such as personal initiative and capabilities like setting objectives, deciding strategies, looking for useful information and so on. To encourage users to acquire these capabilities, the tool assists them in building a job-hunting strategy tailored to their personal needs and attitudes. The tool helps the user to identify the kind of job that suits his/her personality best by describing various forms of employment, related legislation, the aptitudes required, and so on. It also encourages users to draw on the experience of others in order to clarify personal objectives. This is done by granting access to external information sources like employment agencies, employers' organisations and unions, databases, etc. An example of the system interface is shown in Figure 1. The example shows the initial indications the system gives the user in order to help highlight his needs (a preliminary experience aimed at job creation, a job with limited time demand, further training, a job that help build experience, any job at all, an interesting job). Further indications regarding a specific need can be obtained by selecting the corresponding expression (underlined). Experimental uses of the tool have produced very interesting results: when asking for further help from those in the work orientation sector, users are submitting to them plans on how to move and are aware of their needs. In view of its success, the tool can now be consulted in numerous public institutions in our region and is to be adopted at national level [9].

The Mechanical devices multimedia system

The system is designed for stand-alone or networked use in the mechanics lab of technical schools to develop experiences involving the use of mechanical devices. Usually, these experiences are carried out with tools which reproduce exactly actual tools employed in industries.

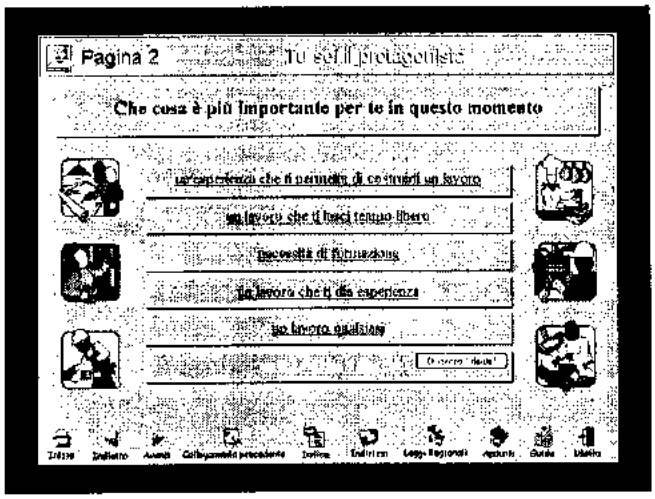

Figure 1. An example of the interface of *Looking for Work*. The Navigation buttons on the bottom allow, respectively to go Home, Previous page, Next page, Back, Index, Useful addresses, Laws, Block notes, Help

For each kind of device, the system comprises three modules:

- description of the working of the device, with particular reference to a given model;
- introduction of theoretical concepts;
- proposal of a number of experiences aimed at verifying the learning of the concepts.

So as to guide the user towards carrying out the experiences autonomously, they have been organised into two groups.
The first group includes examples already developed; each example is associated to an electronic spreadsheet, which shows the experimental data measured, the numerical results obtained, and a graphical representation. From an educational point of view, this group of experiences aims to guide the student to learn by thinking about the work already carried out by others.
The second group includes examples of guided experiences; for each example, the system suggests a line of work and gives indications about the theoretical concepts involved. Moreover, each experience is associated to three electronic spreadsheets, which allow the user to analyse the experimental data according to different levels of guidance (see Figure 2): in the first case, the user inserts the experimental data, and these are analysed by the system; in the second case, the user inserts both data and formulas needed for elaboration in a sheet already prepared with indications about the computations to perform; in the third case, the user has at his/her disposal a sheet to perform the analysis of the experience on his own. This group of experiences aims to lead the student gradually to develop experiences autonomously.

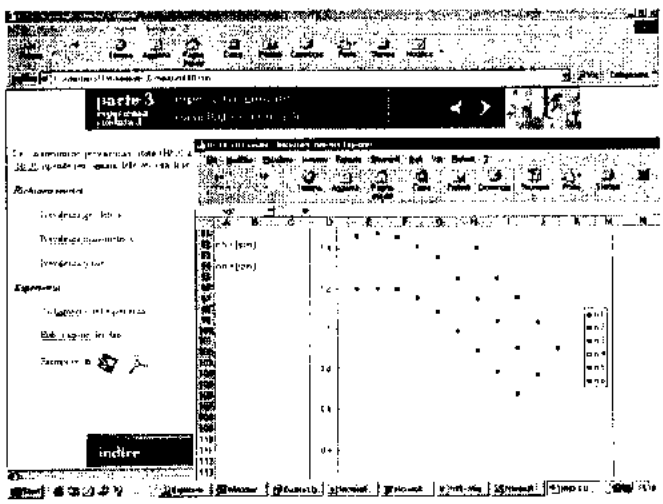

Figure 2. An example of guided experience

Moreover, the adoption of three levels of guidance has several advantages: it avoids problems arising from lack of self-confidence, it allows comparison of results with those of the system-expert, it makes students responsible for their learning, giving them the opportunity to choose the level of guidance. The system, which has been designed and realised within the framework of the Teleconferenza project within the Initiative Adapt of the European Social Fund, is presently under experimentation.

Concluding remarks

Emerging social needs are now demanding that the education system include autonomy in learning among its objectives. This means that a new education model has to be built, one which helps the school transform itself from a centre for transmitting knowledge to one for constructing knowledge. ICT can play a valuable part in this process in a twofold way: by helping teachers to modify their roles, and by guiding students to participate actively in scholastic work. To render effective the educational potential of ICT, however, education research centres, educational institutions and companies need to carry out joint initiatives and projects : these kinds of initiatives give researchers the opportunity to study the feasibility of their ideas and, at the same time, the school sector has the possibility to experiment with research proposals and to become aware of industry needs. These kinds of interactions help to initiate the technology transfer process, which constitutes the basis for transforming research on educational technology into school innovation.

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INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE INTEGRATION OF VISUALLY IMPAIRED STUDENTS FROM SECONDARY SCHOOL TO HIGHER EDUCATION

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Abstract

This paper presents how the usage of new technologies can provide equal chances in education for visually impaired people nowadays. For the availability of the new technologies in the framework of an EVIS project a Study Center for the Blind was established at the Distance Education Center at the Budapest University of Technology and Economics. This Study Center is a Methodology and Information Resource Center for blind and visually impaired students in informatics. This paper presents the results and the experiences of our work in this topic.

1. The role of the computers in the life of visually impaired people

Although the state has made considerable effort in supporting the blind and visually impaired persons they have remainded on the margin of the society, in general they have not been integrated in the world of labour, particularly not in intellectually demanding jobs. Only few of them have been able to attend university courses, their education has focused mainly on much less ambitious job perspecitves. The lack of their real integration in intellectually demanding jobs also means mismanagement with human resources of Hungary, considerable loss of intellectual potential. In this respect the support of visually impaired persons in their education means not only widening the job and life perspectives of the individuals concerned but also the enriching of the human potential of the country.

The secondary education of visually impaired pupils has two problems. On the one hand the career prospects are decreased because of their visually impairment. On the other hand the special education support, which is available in primary schools, does not exist on higher levels of education. They and their teachers can ask nobody for help, and therefore the visually impaired pupils have to overcome their problems alone.

With the appearance of computers new dimensions have been opened up for visually impaired people. Computers can be used, for example, for learning, hobbies and as working equipment. But how can visually impaired people use the computers? With the use of special peripheries: for example Braille display, special speech synthetizer, screen reader and screen magnifier programs.

In Hungary blind people use a special speech synthetizer called Brailab PC ([1], [2]), which is a Hungarian product. It is a small portable adapter for PC compatible computers. Its software has an intelligent built-in screen reader program, which is integrated with the text-to-speech program. Two years ago, in 1998, Brailab CD was released. It is similar to Brailab PC, but it can read DigiBook. Brailab CD can work under DOS (which is the typical platform for blind people) and under Windows with an installed screen reader.

DigiBook is a term for talking books and structured electronic texts. The production of hybrid electronic books is carried out in two phases. On the one hand, there is the structured machine readable electronic text of the book to be read. The structuring could be SGML-based ([3]), for example HTML. On the other hand, we have the audio version of the book, which can be produced in a variety of ways. The audio version will also be structured and linked to the text part of the book. At the end-user side, an SGML-reader with speech or braille output will be necessary, mainly for navigation. The audio part of the book will be used for listening.

Figure 1. (left) A user works with his computer using Brailab PC. Brailab PC can be seen in front of the monitor. (right) Brailab PC from a short distance.

Nowadays computers play a significant role in the whole life of visually impaired people. They already use computers in early intervention in childhood. In figure 1 Márta Gadó, whose results ([4]) are important in vision assessment, watches the reactions of a visually impaired child in front of a touch screen. Gadó made a study about a group of 0-4 -year- old children with low-vision in 1997. For most of them this was the first time, they had ever watched 2D figures continuously. The study reinforces the previously known assumption: computers advance the process of 2D figures and pattern recognition.

Figure 2. Marta Gado watches the reactions of a visually impaired child in front of a touch screen

2. EVIS project

The EVIS (Informatics Education of Visually Impaired Students) project was established between the University of Karlsruhe, Linz, Dresden and the Budapest University of Technology and Economics with the support of the Leonardo da Vinci program.

The aim of the project is to create the conditions for informatics education at Hungarian universities for visually impaired students on the basis of tested models of the previously mentioned universities.

Our most important partner is University of Karlsruhe which has established and runs an Institute for visually impaired students who are integrated in the education of informatics of University of Karlsruhe. The scheme developed in Karlsruhe has been adapted in Prague and Bratislava supported by the PHARE TEMPUS Program. Since the social and economical environment of these countries is quite similar to that of Hungary the utilisation of their experience is important.

The objective of the project is twofold:
a/ establishment and development of an inter-university centre with international co-operation for helping the preparation of visually impaired individuals for university studies
b/ integration of visually impaired students into the education of informatics at the Budapest University of Technology and Economics.

3. Results and experiences

One of the results of the project is that the Study Center for the Blind was founded at the university. There is a special workstation for blind and visually impaired students in the Center. In Hungary this workstation has a unique feature: all Windows-based screen readers (WinEyes, WinTalker, WinJaws) are installed on it. Therefore we provide the chance for students and computer experts to try out and get to familiarize with the programs of the highest technical level available.

One of our main tasks is the development of materials. We have developed a method for converting materials into electronic format. There were some problems with the conversion of mathematical and the other technical signs and symbols, but we could overcome them with the help of blind computer experts. From the budget of the project and from the support of the Soros Foundation we made the materials of the first three semesters in electronic format.

During the project we have collected experience about what problems of the teachers of the visually impaired students encountered and how they managed to overcome. The main problem for the teachers that they have not met visually impaired students until now, therefore they do not have experience to teach them. When they write or draw on blackboards they rarely explain, just point or refer to their writings and drawings. They do not know how they can explain things that are trivial for sighted students.

In addition to material conversion we have collected all the information about the subjects. We use questionnaires for it. From these questionnaires we can get to know the requirements of the subjects, the chances for helping the visually impaired student to prepare for the lessons and the examinations. The main topic of the questionnaires is the existance and the available formats of the syllabi. It is essential for us to know that the materials will be changed in the near future and if there is a chance of introducing new syllabi and new textbooks.

The number of visually impaired students who use computers continuously keeps growing. They use computers for taking notes, reading, doing homework and writing tests. Until now students have had few chances to get a degree in informatics at universities. Because of gaps in their secondary school knowledge they have often failed the mathematics and physics exams. Even if they could pass the entrance examination several problems already arose at the first examinations. One result of the project is that we organize preparation courses in Budapest for students at secondary schools.

Since claims arose from other Hungarian cities to attend these courses we try to provide them with course materials as well as distance learning packages by email. From the experience of the entrance examinations we determined the needs for taking these examinations successfully. We have achieved that examiners can choose the best writing mode and devices (e.g. Braille writing, screen magnifier) for taking the examinations successfully. For accepted students we have created several helping methods to fulfil the university requirements. We prepare visually impaired people's classmates (tutors) for helping them during preparation for the examinations. We organize consultative meetings for solving the problems of visually impaired students and where if it is necessary blind computer experts can also help.

As well as helping them, we would like to give chances to secondary school and other students so as to attend international computer camps. With the foreign partners of the project we became the member of International Computer Camp Association, which organizes summer camps for students of 15-18 and 18-20 years of age. The goal of the camp is to get to know the basics of computers, make friends and practise English.

4. A plan for a network between the Center and the universities

Our main goal is to extend the tasks of the Center: we expect not only to help the Technical University's visually impaired students, but our Center will also have to become a Methodology and Information Resource Center. To this end we have entered cooperation agreements with the largest universities and colleges of the country. Our goal is to set up a network that provides help for students all around the country. The establishment of a computer-based database is in progress, which contains the syllabi in electronic format. Furthermore, we have undertaken training tutors, student helpers and preparing teachers for specialities of visual impairment.

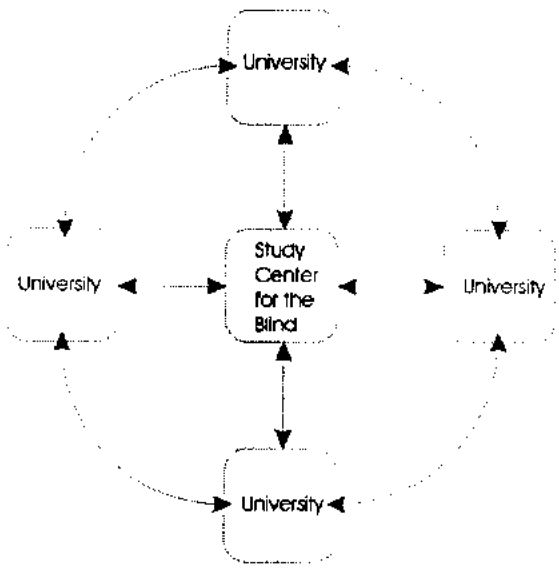

Figure 3. A plan for the network between the Center and the universities

5. Conclusion

Nowadays only a few visually impaired people study informatics at universities. For those pupils who did not pass the entrance exams and for those visually impaired intellectual computer users special courses in informatics are necessary. As there are not such courses in Hungary yet the Center would introduce this kind of further education. Because of this we plan to develop the basics of such special courses in informatics with the help of foreign partners, Hungarian Association for the Blind and Partially Sighted, secondary schools for informatics and the Faculty of Electrical Engineering and Informatics at Budapest University of Technology and Economics.

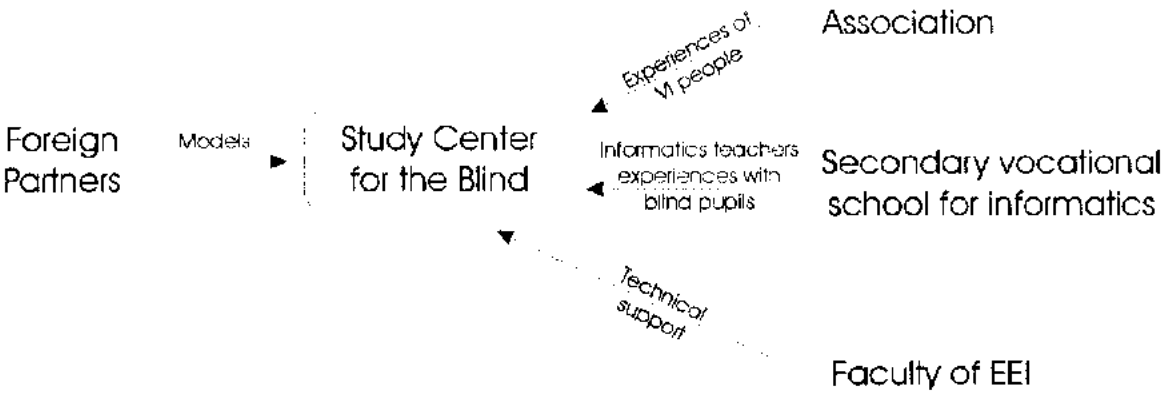

Figure 4. The plan for the architecture of the special computer courses

We hope our initiatives will create equal chances for visually impaired people in studying and career prospects.

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LANGUAGE IN COMMUNITY AND SCHOOL

Elda GJERGJI, University of Elbasan

"The key to understanding the significance of the activities of plants, mammals, and man is the recognition of their homeostatic nature, and the fact that they tend to preserve the continuity of life". (Young)

"A person anticipates events by construing their replications" (G. Kelly)

These two quotations, one from a biologist, one from a psychologist, give us our point of departure, for they remind us the fact that there are many ways of looking at man, each one of which may add something valuable to the total picture we are interested in building. No one of us can ever experience all the possible ways of looking or seeing for ourselves but we can make use of the "seeing" of others by testing them out against our own experience of the world. This is what we shall try to do with these two ways of seeing.

The word "homeostasis' was used for the first time by a physiologist who was writing about a tendency observed in mammals to maintain constant the composition of their blood in spite of changes in their environment. "Homeostasis" means literally a " steady standing", a state of equilibrium or balance relative to the surrounding environment. Related specifically to man, the concept of homeostasis allows us to suggest that man is designed to keep himself is a state of balance with his immediate environment, and that this involves not only a balance in terms of his function as a living organism, like his need to keep constant the composition of his own blood, but also in terms of his existence as a social and cultural being, a thinking self.

Through they may find in their work little to support traditional distinctions between " mind" and "body" or " reason" and " emotion", their view of man does not exclude the behavior which we associate with our use of these words. What they offer us is a view of man embraces both his biological continuity with al other living things, and his distinctiveness as a species which has learnt how to emancipate itself from subjection to the constraints of the natural environment by using its brain to create its own environment. In other words, what makes man man is the fact that he has created for himself a social and cultural context which is form him his "natural" environment, the environment without which he cannot survive as an individual.

Young describes as the individual human being's commitment to maintaining a steady state in relation to his physical, his social and his cultural environment, the psychologist, Kelly, describes as the individual human being seeking always to anticipate events by predicting that they are about to happen before.

The pupils in front of us, an individual human being who has learnt how to maintain himself in a steady state with his total environment, who has built up a system of personal constructs in the process to enable him to interpret his immediate experience, an experience largely shaped by the social and cultural life of a particular community, and a high proportion of whose existing constructs, therefore, are likely to have a limited range of convenience. What happens when he comes into this new environment of the school? How is he to maintain himself in equilibrium by adjusting to this new social and cultural environment? What does he do when he has to operate outside the range of convenience of so many of his constructs?

Part of the answer is that constructs can be modified, through this takes time, often a very long time. Part of the answer is that it is more efficient for a human being to be able to use initially the constructs it has whatever the immediate consequences of their limited range of convenience than to try to develop a large number of new constructs all at once. As we build our constructs by testing our predictions against real events, we have to be able to experience the falsification of our predictions, not once only, but often many times, before we can accept a modification to the construct concered.

For some teachers, perhaps, the idea that what they see as "lethargy", 'stupidity" in their pupils could be explained in terms of the way a human being is designed to function, may be difficult to accept, but it may be more profitable in the long run.

The language used by adults that the young child learnt to use language itself and learnt the ways of behaving in use in his community, so it is through different environment of the school that the school-age child meets new ways of behaving, new do's and don'ts. As the child comes to handle its language it meets and talks to other children, visits other homes, compares experiences, it sees the possibility of alternatives. Once a child can see the possibility of alternatives to the view of things it has derived from its experience which of primary socialisation, there are thus ultimately changing. It has to be said, however, that some authorities would insist that such changes be only ever concerned with relatively unimportant matters and that we carry the marks of our primary socialisation with us to the grave.

The school is not a community, in the full sense of our definition. However, like al institutions with an active life of their own, a school does create for the newcomer the conditions that we have titled as socialisation. In so far as it does socialse those who enter its life, then we can think of it as a particular kind of community. Indeed, there is a long tradition in this country that values the life of the school as a community above its function in imparting knowledge. What we have said about the individual in his own community, therefore, we can now apply to the pupil within the "community" of the school. He joins an institution with a welldeveloped set of values, attitudes and assumptions. What happens if he protest at their implications for his own activities? What happens if the school does not like his values his attitudes and assumptions, or his ways of behaving and his ways of using language?

Where schools differ radically from communities is that school is socialising individuals who do already have a value system of their own. This is why the distinction between primary and secondary socialisation is so very important. A community undertakes the primary socialisation of a member who enters it possessing neither language, nor an organized way of looking at the world, while a school creates the conditions for the secondary socialisation of an individual who already has a language and a culture of his own. Unfortunately some schools and some teachers persist in regarding their pupils as "empty vessels" or "blank sheets" wanting only the imparting of particular bodies of information in order that their initial ignorance be transformed into later knowledge. To them, all that is relevant is that pupils are ignorant, until instructed in things which the school values as knowledge. If they fail to learn, the fault lies in them. Failure of this kind in the context of the community of the school, however, is so often read by the school as a global failure of the pupil as a person. His success in living the life of his own community is irrelevant, yet to the individual pupil this success is necessarily the basis of his integrity as a person.

From all of this, we must accept that a conflict between alternative culture is extremely likely to arise when a child goes to school. When we consider the capacity of a child to cope with the world, however, conflicting views are not in themselves a threat. It is the child's ability to cope with the conflict of views that he meets which would seem to us of real importance, not the mere occurrence of conflict itself. Ultimately, if a child is unable to work out a solution to a problem of this kind, it experiences a kind of frustration which we may not yet fully understand, but those results we are only too familiar with in terms of a total rejection of all we try to offer in the classroom. How then can we help the child to resolve problems of this kind when it goes to school? The language it already possesses the ways of seeing it has available, and its previous experience of the world, which can draw upon by using language inside its head. All of this, however, the child brings with him from his life in the community. What a child comes to school with is both a language and a culture each closely bound up with his experience of the other, but it is this language that he must use for learning to be a pupil and for acquiring the "language for learning" that the school will use throughout the pupil's years of education.

THE OBSERVATORY OF THE ICT IN HIGH SCHOOL CENTRES

Albert Sangrà, Academic Director (UOC), Andreu Bellot, Instructional Designer (UOC)

What is it?

- The observatory of ICT in non-university schools is a project implemented by Jaume Bofill Foundation and the Edu Lab of the Universitat Oberta de Catalunya, whose purpose is to analyse the use of information and communication technologies (ICT) in the education.

Main goals

- Measuring the evolution of real use of ICT in non-university schools
- Comparing the use of ICT in different communities and countries
- Detecting useful ideas for the centres to act with a future view
- Creating topics for discussion around the pedagogical use of ICT

Who is participating?

Around 33 centres in Catalonia with different characteristics according to their ownership, population and technologies resources are taking part of a proof to examine (from survey, interviews, round tables and discussions) the situation of the use of ICT.

An assessment council integrated by experts who undertake the use of ICT in non-university school from different fields (trainer of trainers, teachers association, educational administration, etc) are establishing the principles of the project from the analysis of the sample centres work.

A technical team undertakes the communication with the sample centres, from the data collecting and analysis, the research diffusion, and the main conclusions reached every time.

Main aspects subject to study by the observatory

There are many aspects to consider with regard to the ICT use in the non university school. The study of the following list of questions adduce a pedagogical enrichment in the use of ICT in the non university centres. We will formulate hypothesis for each aspect and the study will be orientated attending two criteria:

- Possibility of having conclusions more or less immediate and useful to make better the use of ICT.
- Interest demonstrated from the centres and educational institutions involved in the project.

Work Methodology

- **The use of ICT by teaching staff:** Knowing how teachers use the ICT can help us to answer questions like: Is it a priority? Is another resource for the teacher? Is a qualitative improvement? What is the contribution of ICT to the educational process?
- **Strategies the use of the ICT are responding to.** It is worth to detect the motivation that teaching staff has to implement ICT in the centre. Is it a new pedagogical resource? Is it just a motivation tool?...
- **The presence in the centres of interschool projects as a result of the use of ICT.** Detecting new experiences can help the Observatory to evaluate changes in the methodology, in the standard of learning and the motivation of the pupils as well as detecting which changes the curricular design is making (basically focussed on the

interdisciplinary) comparing co-operative projects with other individual projects focussed in the school without the participation of the ICT.

- **Changes in the pedagogical exposition of the centre according to the use of ICT.** Knowing if the use of ICT raise the co-operative work or reinforce the individual one either the pupils or the teachers, if teachers are forced to expose the subject in a different way. How do work teachers with pupils? And with the rest of the teaching staff?
- **The interdisciplinary:** Although the curricular design is made to be interdisciplinary most of the times the credits proposed become insulated from the rest of the curriculum. Can the use of ICT promote a learning planning more interdisciplinary?
- **Strategies of the teaching staff to re-establish curricular projects according to the use of ICT.** Knowing if planning are re-established according to the use of ICT. It is very important to detect the consideration of the teaching staff face to ICT. Is the new technologies another resource or an essential tool of work that helps to articulate a credit.
- **Departments (credits, subjects...) with more affinity to the use of ICT.** Are there any areas that have tendency towards the use of ICT?
- **The integration of ICT in the curricular project.** Has any influence the use of ICT to the curricular project of the centre?
- **The capacity of innovation of the teaching staff in the centres which use ICT.** Do teaching staff work as usual when using ICT or this use allows teachers to make innovations affording a qualitative improvement? How do teaching staff value the changes made when using ICT?

Teaching staff

- **The use done by teaching staff of ICT** We do believe knowing what are the uses made by teaching staff of the new technologies. The point is knowing if teachers have a priority in the use of ICT. Do teaching staff consider ICT as a pedagogical resource or it is only another tool else to develop their job?
- **The re-definement of the curricular project according to the use of ICT.** We value the necessity of knowing if the curricular project has been modified because of the use ICT. Do the modifications in the curriculum make better its understanding, and its adaptability to the different levels of pupils making better and wider the subject to course?
- **The innovation in the centres through teachers that use ICT:** The point is knowing if the use of the ICT produce innovation in the pedagogical field, new ways of work organisation, increasing of the interdisciplinary work and increasing of co-operation among different centres.
- **Changes in the role of teaching staff.** Traditionally, the teacher assumed the role of knowledge transmitting. How do modify ICT this change of mentality? We have to value if the following aspects affects in the work of the teaching staff: research through Internet, teachers on-line and changes of the pedagogical exposition when using computers.
- **Attitude of the teaching staff face ICT:** The complicity of teaching staff is essential to implement ICT in the centres. This is the raison why it is necessary to know the attitude of teachers. Knowing the grade of implication will help us to know the consensus in the cluster about the use of ICT. Moreover, detecting how teachers see the use of ICT become essential to suppose how difficult, or easy, will be the penetration of ICT in these centres. Mistrust for not knowing how to use them? Uncertainty for the changes implied for using usually ICT? Or, contrariwise, we are talking about been enthusiastic for been able to innovate?

Pupils

- **How to manage the information received by pupils through Internet.** Are there any filters established by teachers? Does the quantity, and sometimes the lack of quality, of the information going round by Internet unable a correct evaluation of its possibility of use? How do pupils use this information?
- **The use of ICT as a possible generator of inequality.** Can a new borderline born between pupils with more initiative and some others passives face the use of the computers. Is it possible to have pupils passing the subjects successfully in the traditional educational but not motivated at using the ICT in the new model of learning? On the other hand, economic inequality among pupils can be widely increased because of the use of ICT in educational centres? Or, contrariwise, the use of ICT become an element which democratize the access and improvement of learning?
- **The abilities related with the reading and writing of pupils.** Which use do pupils of ICT and how are they affected? Are these abilities condition for been useful at using ICT? Do the use of ICT make worse these traditional abilities?
- **The motivation of the pupil** Is a real motivation the use of ICT that brings improvement in the capacity of learning?
- **The variation of the relation of ICT with pupils.** How do the learning of ICT (either the formal one in the school or the intuitive at home) is integrated by pupils? How do they front the learning of a new environment or a new program?

Educational centres and its organisation

- **The consensus in the cluster about the use of ICT.** The use of the ICT as a pedagogical tool of the centre is an aspect to discuss in the cluster, it would exist different inclinations among teaching staff (People against and for). Observing the vision that each cluster has about the use of ICT can help us to detect inclinations and difficulties of each centre.
- **The appearance of new private educational services through Internet (teachers on-line, new educational software)** The thing is to check if the proliferation of these services make evident the limitations of the own centres to reply for the pedagogical necessities of their pupils modifying, in a certain way, the role of the teacher in the classroom.
- **The performance organisational in the centre**. Technology serve to the professionals that use it. From this point of view we think is worth to know if the infrastructure of communication has been modified among the members of the educational community of the centre for the application of the new technologies. It would be important to know also if the bureaucratic process has been modified and the administrative management (making them shorter and quicker) before and after using ICT. Is the communication process with parents and pupils better than before?

The reports of the observatory

Every three months the observatory will make a thematic report reflecting all the study conclusions and the exchange of information with the centres.

The objective of the report is to gather in a systematic way the reality and the work made by the centres with the new technologies in order to obtain a dynamic image about the activities, the expositions and the problems the centres find when implementing new technologies.

The reports are directly linked with those aspects that we pretend to study in the observatory. Three reports will be published in 2000:

- **First report - April 2000:** the reality of the centres will be analysed according to their software and number of PCs, the activities usually made which are based on pedagogic expositions.

- **Second report - July 2000**: the teaching staff role will be analysed in the setting up of ICT, changes in the teaching staff role and their attitude towards the ICT.
- **Third report - November 2000:** First of all, we will study the relationship between pupils and new technologies, the way to manage the information obtained by the pupils from Internet, to know if ICT generates differences, pupils reading and writing improvement with the use of ICT, and their motivation.

The observatory web

The observatory web page is, mainly, an informative reference based on what is done and offered:

- Framework for non-university professionals who use ICT, exchange of experiences
- Framework for the exchange of experiences in innovation projects
- Innovation initiatives as a way to implement achievements in the dialogue between ICT and the educational community members
- Knowledge viewed as a way to improve in the ICT use in educational centres
- Discussions for enriching all the opinions about this subject

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EVALUATING THE USABILITY OF MULTIMEDIA EDUCATIONAL SOFTWARE FOR USE IN THE CLASSROOM USING A «COMBINATORY EVALUATION» APPROACH

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Abstract

In this paper we present our experience from the evaluation of "Perivallon", a multimedia educational software for use in the second and third junior highschool classes. The "Perivallon" software (developed as part of the Greek Ministry of Education "Odysseia"-project) is intended to be used in the classroom during the lesson of biology, aiding the teacher in his work by providing him with the multimedia and other capabilities of the contemporary computer systems.

We applied two evaluation methodologies to assess the usability of the interface: a variation of a "Cognitive Walkthrough" an expert-based method developed in our lab, and an additional testing with real users in the school environment. While designing the two methodologies, we applied the same goal-task-action approach to both of them, so that the results of the two sessions would be comparable.

In addition, we assessed the efficiency of the evaluation methodologies used and we propose some modifications to enhance their efficiency. We present these results as well as the results from the comparison of more than one evaluation methods to achieve reliable and valid results.

Keywords

Evaluation, Educational Software, Cognitive Walkthroughs, Cognitive Graphical Jogthrough, Usability Testing, Observational Evaluation, Survey Evaluation.

Introduction

The software under consideration has been developed in the framework of the "Odysseia" project, subproject "Nausica" of the Greek Ministry of Education. The "Odysseia" project –with all its subprojects- aims to embed the new technologies (eg. computer-supported instruction, telematic applications, Internet etc.) in the educational environment of the Greek secondary education level (junior and senior highschool students - aged between 13-18 years old) and is partially funded by the European Union. The subproject "Nausica" deals with the multimedia educational software development for use in the classroom.

Description of the software under evaluation

The software under consideration –titled "Perivallon", which means "Environment" in Greek- was submitted for evaluation to our Multimedia Laboratory in February 2000. It concerns a multimedia educational software for 14-15 year old pupils and is designed to support the class of biology. The intention of the designers was to offer a full educational environment with extensions in the domains of Physics and Chemistry, as they are described in the teaching guidelines of the Greek Ministry of Education.

The design of the software based on the following pillars:

- A tutor is indispensable during the use of the software, which means that it was not designed as a stand alone educational environment.
- The basic information of the lesson is provided in the form of text, pictures, sound and animations.
- There is additional information in the form of simulations.

- It enables the pupil to work with it by cutting and pasting "pages" from the main information space to a space defined as "pupil's workspace".

The main working area of the learning environment ulilizes the metaphor of a "videoconsole". The user puts a "videotape", which includes the information relative to the current lesson into the console and by activating it he/she follows the lesson and interacts with it as well. The pupil's workspace consists of a second console, where the student inserts an "empty" videotape, where he can copy information from the main workspace, assembling thus his/her own "video".

Description of the used evaluation approach

The software under consideration was still in the development stage, so we had to apply a formative approach to get the appropriate feedback to support its redesign. We decided to use an expert-based methodology - in particular a modified Cognitive Walkthrough method, the CGJ - in addition to real user testing in the Experimental ("Peiramatico") School of the Aristotle University -in particular a combination of observational and survey evaluation, which we named "combinatory evaluation"-, so we would be able to compare the evolved results from the two approaches. Both methods have been proved as suitable for formative evaluation and their advantages and disadvantages indicatively reffered to by Preece (1994), Shneiderman (1998), Nielsen (1993), Lewis & Rieman (1994) among other studies seem to complement one another. We decided to ascertain this statement as well.

We did not evaluate any cognitive aspects of the software, assuming that they were in accordance with the guidelines of the Greek Ministry of Education. We mainly evaluated the user interface of the software in particular, the usability of the system as described in ISO (1998) and FιΩkjΨr et al (2000).

Description of the goal-task-action approach.

To evaluate the software we followed the goal-task-action approach by separating the software in distinct tasks and actions.

The used evaluation methodologies

a. The Cognitive Graphical Jogthrough (CGJ) method

This method belongs to the expert-based evaluation methodologies, where experts are asked to play the role of potential users and judge the interface. It is based on the well known Cognitive Walkthrough (Polson et al.,1992; Wharton et al., 1994) and Cognitive Jogthrough (Rowley et al., 1992; Aedo et al., 1996; Catenazzi et al., 1997) methods, and is described in detail in its current form that we propose in Demetriades et al. (1998), Demetriades et al. (1999), Karoulis et al. (2000). We used our modified version because of its advantage of being able to assess not only walk-up-and-use interfaces, like the former Cognitive Walkthrough methods, but educational ones as well, since it takes under consideration the variable of novice-becoming-expert user.

b. The empirical survey and observational evaluation methodologies.

These evaluation methodologies involve real users in the evaluation procedure and the persons conducting the evaluation as well. According to Benyon et al (1990) we distinguish between survey evaluation, where questionnaires and/or interviews are used to record users' opinions, and observational evaluations, where users work with the system and one or more observers (or appropriate equipment or software) notify the occurences and the users' reactions. These methods are described in detail in the relevant literature, as in Preece et al. (1994), Lewis & Rieman (1994), Nielsen (1993), and Shneiderman (1998).

In our case we used both methods (observational and syrvey) in a «combinatory evaluation» approach. The users had to work with the system, while two evaluators observed the occurences and noted them in an appropriate «observer's notebook». Afterwards, the users had to answer the survey. The questionnaires of the survey part of our approach had a compact form consisting of no more than the basic questions (since the users are pupils aged 14-15 years) and divided into two groups of questions: the first group consisted of five Lickert-Scale type questions, while the second one consisted of five open-ended questions.

At this point, we pinpoint the main research questions we wanted to elicit from our study:

1. The evaluators used their notes immediately after the session so that they could fill out an «evaluators questionnaire», which consisted exactly the same questions as the users' questionnaires for every particular participant. The evaluators were asked to answer the questions in the way they judged that the particular user acted in the context of every question during the use of the system. As a result, we could afterwards compare the users' answers with the opinions of the evaluators about what the users realy did. We called the special evaluators' questionnaire « Evaluator's Questionnaire for User – EQU». The reason for following this approach was the lack of reliability that has been observed in a number of studies, partially because of the existence of several methodological pitfalls (Holleran, 1991; Landauer, 1988) and because of the dilemma «users are always right vs. users are not always right» mentioned by Nielsen (1993) and Nielsen (2000). So we tried to answer a first core question: «Are the users' opinions, especially in young ages, valid?».
2. Of course, there are a number of studies over this topic, like Root & Draper (1983) and Karis & Zeigler (1989) arguing for the opposite, but our locus was more on the comparison of the EQU vs. the users' questionnaires. In order to achieve this we upgraded the role of the observer-evaluator making him a connector between the users and the experts. So the second question to be answered is: «Is the EQU a solution for the 'unreliable' surveys?»
3. Both evaluation approaches (expert based and user testing) followed the same task-action sequence. This means that the pupils were asked to perform the same tasks that had previously been evaluated by the experts, so we got comparable results so that we could answer the third core question: «Are the results from expert-based methodologies in agreement with those of the real user testing?»

The evaluation procedures themselves

The CGJ session

The session itself ran as we planned. All the tasks and actions were evaluated in the estimated time and the evaluators discovered 5 critical, 7 major and 6 secondary usability problems.

The empirical session

In this session 2 evaluators and 15 pupils, 5 of the second and 10 of the third junior highschool class, 7 boys and 8 girls were involved.

In general, the pupils' estimations were more tolerant and gave higher grades to the system than the experts and the two observers-evaluators.

They discovered 7 critical, 7 major and 3 secondary usability problems that correspond to the findings of the experts as shown in Table II.

	Experts	Pupils	Common findings A	Common findings B
Critical Usability Problems	5	7	3	10
Major Usability Problems	7	7	2	
Secondary Problems	6	4	2	3
Summary:	18	18	7	13
Different Problems	4	3		

Table II: Comparison of the findings by the experts and the users

The results

Not all children did find the same problems. On average, every pupil found about 8 problems, and our field observations found out that 8 to 10 pupils would be sufficient to find out the complete set of all the 21 totally found problems. In addition to the above, we noted that they mentioned some issues that were not problems at all («the room (main screen) is in a mess!» or «we want to use it at home»). We didn't

count these observations, but we took into consideration 3 problems that the children noted, but the evaluators didn't notice. On the other hand the evaluators found 4 problems that the children did not mention. These findings are noted in the «Different Problems» row, they are not counted in the results, but they are discussed in the «discussion session».

The characterization of the severity of the problems is according to Nielsen (1992) as follows: «Major usability problems are those that have serious potential for confusing users or causing them to use the system erroneously while minor problems may slow down the interaction or incovenience users unnecessarily». We modified this approach by characterizing them as «critical usability problems», «major usability problems» and adding the class of «secondary problems» (the word «usability» felt away) reffering to problems which are graphical in origin, or misplaced objects on the screen (that do not affect the usability).

By categorizing the problems as «critical, major and secondary», it seems that we miss something: only 3 critical and 2 major (total 5) of the found problems seem to be common. This is not true, because the whole proceeding of the evaluation gave the feeling of a broader agreement, since in fact they found 18 common problems. The difference comes from the severity grade: if an evaluator considers problen A as critical, but the user as major, then this is not marked as «common». By aggregating the two first categories, we have a greater coincidence: 13 common of 18 total common. The rest 5 are problems with big disagreement; this means that one group characterized them as critical although the other one thought they were only secondary problems.

Another interesting finding came from the side of the observers: they noted that in the most cases that the pupils encountered a usability problem, but they were able to overcome it in feasible time, the pupils did not mention it as such. But the experts did, reducing thus the common found problems. This is the meaning of the last column of Table II, showing the real correspondence between the usability problems found by the experts and the users.

Discussion and Conclusions

1. Firstly, we propose not to categorize the problems as «critical, major and secondary», since it seems to provide difficulties during the elaboration of the findings. The design team can assess them afterwards on their own to implement the proposals in the redesign procedure.

2. The fact of the "different problems" found from the experts and the users provides more evidence that the expert-based and the user-based evaluation methods must be combined in a kind of "combinatory evaluation" in order not to miss important data about critical usability problems. Our observations gave two different points of view: The experts critisized the lack of audio cues, the highlighting of objects (the children are not aware of the possibility to use these things), the used metaphor (videoconsole) and the swap of the place of the consoles between the main screen and the users'-workspace-screen (the children didn't even notice). On the contrary, the children mentioned the illegible text, the bad quality of the video (the experts are aware of the technology constraints, the children aren't) and the captions of the pictures (the experts didn't even read them). It is obvious that every evaluator group assess the interface from its own point of view. So if we follow only one approach, it is better than nothing (Nielsen, 1993) whereas combining both approaches provides a greater possibility for more accurate results. The art and theoretical framework of this "combinatory evaluation" needs to be further investigated.

At this point, we may answer the third question («Are the results from expert-based methodologies in agreement to those of the real user testing?») as follows:

The experts, in general, consider every formal usability problem as such, even if the users can overcome it relatively easily. This is one explanation for the finding of many other studies - eg. (Lewis & Rieman, 1994), (Preece et al., 1994) that only testing with real users provides direct information about what their exact problems are with the concrete interface being tested (Nielsen, 1993). Karat et al. (1992) argues for it as well: «The empirical testing identified the largest number of problems, and identified a significant number of relatively severe problems that were missed by the walkthrough» and «about a third of the significant usability problems were common across all methods». Jeffries et al (1991) found the walkthrough technique less efficient than usability testing and argues to use it only if there are not real

users available. Based on the results from our study we argue for the opposite, because in the meantime a great deal of progress has been made towards the evolution of the walkthrough methods:

- the addition of the diagrams makes the method suitable even to non-walk-up-and-use interfaces,
- the evaluators' expertise not only as usability experts, but rather as a multidisciplinary team, augments the effectiveness of these methods,
- due to the acceleration of the procedure, more tasks can be evaluated at the same time thus providing a more global view of the interface and,
- a more formal preparation of the task sequence raise the method to a better level

We believe that the usability testing has still the advantage, but the CGJ provides now a valuable alternative and not a «better-than-nothing» solution. But, finally, one should conduct both approaches, if possible.

3. About the second question («Is the EQU a solution for the 'unreliable' surveys?»): The evaluators-observers served during the session as «connectors» between the users and the experts, they corrected the (high) assessments of the users, clarified some of the hardly interpretable writings of the users, and, most important, they noticed the usability problems the users didn't stop at. Since it was our first study on this topic, we can say as «pilot finding», that this approach seems to fill a gap between what the users consider that happens and what really happens. We need more evidence on this topic, but one conclusion is lucid: the evaluators-observers made a great deal of effort to observe, assess the occurences and write down their osbervations. So we propose engaging more evaluators per user, which is obviously a disadvantage of this approach.

4. After all, the answer to the first question («Are the users' opinions, especially in young ages, valid?») emerges as following: The users' opinions can be «transformed» or, better, «interpreted» to become valid. The validity of their answers can be extracted with the aid of the evaluator-observer, the EQU, the common goals-task-actions-approach, and the more formal conduction of the whole procedure. There was not unanimity between the users' and experts' opinions, but there was a high reported grade of coincidence between the two groups as reported up to now.

Concluding, we argue that, in this combination, the methods seemed to unfold their full potential, giving the «combinatory evaluation» the opportunity and at the same time the need to be further investigated, because of the higher grade of efficiency it can provide.

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DISTANCE LEARNING AT SECONDARY LEVELS: CONTEXTS AND NORMS FOR THE LEARNING OF MATHEMATICS

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Distance Learning for Secondary Education

Since 1998 the Departaments de Didàctica de la Matemàtica i les Ciències Experimentals of both Universitat Autònoma de Barcelona & Universitat de Barcelona, develop a research project concerning the use of the Internet to attend those students who are not able to go to school regularly, specially those at the hospital or at home (Gimenez & Fortuny, 2000), and high performance athletes (Figueiras, 2000). In other papers we have discussed some aspects relating the communication model used by tutor and students under the influence of technology - web pages, e-mail, electronic forums, - and the impact that a virtual tutor has on the students participating in the experience (Figueiras, 2000; Fortuny et al. 1999). Specially in mathematics, the syntax of its language shape some of the learners' actions to make the others know about their progress.

We also detect a great influence of tutor's and students' context arising from the case studies carried out on statistics, algebra and geometry. It is an influence on both the way they manage the experience of learning at a distance, and the way they access to the contents,. This and its contribution to the norms they agree for developing the experience are the discussion points of this paper.

A great amount of the work carried out on distance training and self-learning attend university or professional levels, for it aims to be used by those adults who engage a working society highly influenced by the actual self-learning paradigm. Within this frame, it is supposed that many of the knowledge that people have when access to a job has been acquired using self-learning programs and, moreover, that it is an up to date learning (Duart, 2000; Guigou, 1999). However, this paradigm is quite different when adapting and justifying the use of new technologies for communication in secondary levels of education, for aspects such as affect, curricular constraints, and the influence of technology on the motivation and willingness to learn, become more valued (Brieba, 2000): Personal contact among peers and teachers has a high relevance at this level of education and responses to questions concerning why should we introduce distance learning experiences has not an immediate answer. Standards for secondary education emphasise objectives to be carried out in a classroom setting, such as peer-discussion in a community; handling of objects in the space; learning how to speak and moderate a debate; and we are far away from consolidated proposals joining the use of distance learning to the objectives of the actual curricula. Rejecting simplistic approximations concluding if the conversion from a non-technology-oriented course structure to a technology-oriented one led to a quantifiable difference of any sort, our commitment in this specific project is a social and politic one: distance education at a secondary level to attend those people for whom it seems to be the best opportunity, specially the use of the Internet.

Dynamic contract, sociomathematical norms and context influences

Different situations led us to adapt learning units for learning at a distance to the different contexts in which the learners develop their activity. Evidence in the cases studied suggests focus in the way it modifies the design of the learning environments and curricula adaptation for each setting.

The influence of the family is an important factor to take into account with hospitalised students (Muria et al. 2000). When students work at home, and even when they communicate with their tutors, usually do it in the company of their relatives, who work with them. If the correspondent activities do not take into account this factor, there is no possibility for the tutor to follow the student by observing only their communication via e-mail, and there is a need to engage the family in the experience and make explicit their role together with the ones of tutors and students. This is the main point to create a new setting for learning and not to force the students to reproduce at a distance the norms and constraints which they have learnt that prevail in the classroom.

This must be also applied to the case of high performance athletes, who due to sport training must be absent from school for long periods of time. However, the role of the family has almost no influence when planning or designing the environment to be used during the tutorial, but the hard training sessions and press of the competition arise as the main factors that mould the learning experience of the student:

> *I am a bit lost with these of determinants. I did not know how to do anything for you and I hope that you will help me tomorrow. The videoconference doesn't work, it may be the change of the modem, I don't know. Let's meet tomorrow at 12h o'clock to communicate by telephone or chat. Maybe that the championships are coming closer and I cannot concentrate.* (Figueiras, 1999)

This kind of assertions are a key to adapt the contents to the special situation of the student, and shows not only the influence of the natural context in the student's activity, but the implicit agreements arising during the experience. It is important for the tutor to recognise it as a new agreement in the relationship that he/she construct with the student. In the example above, the student assumes that the high grade of flexible learning permits him to look for spaces of collaboration in order to cover the program. This occurs not at the beginning of the tutorial but later, while he maintains a personal relationship with his tutor.

Therefore, we face different norms or rules, what we here roughly label as *contract*, some of them implicitly assumed by the learners as a result of their interaction, and some of them stated from the very beginning of the experience (fig. 1). Moreover, these rules are continuously re-negotiated, and new ones appear leading us to a dynamic view of this contract. It is not possible to conduct the experience under the rules of a planned contract unless it deal with this dynamic process. Keys for the construction of these rules need to be recognised by the learners and, in the contexts of distance education we are dealing with, they must look for them in their written conversations via e-mail. For this reason is important to describe and familiarise with the kind of actions that permit us to communicate and collaborate at a distance. If the participants learn how to participate (by writing) on a electronic conversation and how to express ideas related to the specific contents, they mould their actions to make the other know about their own interests, implicitly or explicitly. Distance learning and people who engage on-line courses require a new interpretation of *context* and its dimensions (Badia et al. 2000).

Two main aspects are directly related with the context of the experiences we are discussing: the design of the activities concerning didactical and pedagogical issues of the course proposed, and an important and not yet sufficiently investigated question: the student's rejoining the school setting after the conducted tutorial.

Adapted Design for a dynamic process

For each one of the cases proposed to be attended, a web-based environment is prepared for the student to cover the same curriculum which is considered at the corespondent school. Thus, there is a decision to give priority to the program followed by the current teacher. To this extent, the main point in the exploratory studies has been to investigate the way in which this new learning settings permit the student to follow his or her learning activities, more than to innovate or to experiment a new *mosaic* knowledge, as a hypertext system like the Internet suggest.

Interactive points have been used, discussed and analysed to know and let the learners know about socialisation roles of tutor and students, and its influence in the relationship among them and the materials. Internet is the most significant contact with the mathematical activity for these students, and giving references, using reactions, or emotional activation resources, are considered beyond a classical *talk-with-the-tutor* way of interaction. Figure 2 enlighten this points attending a personal experience of a sick student studying at home.

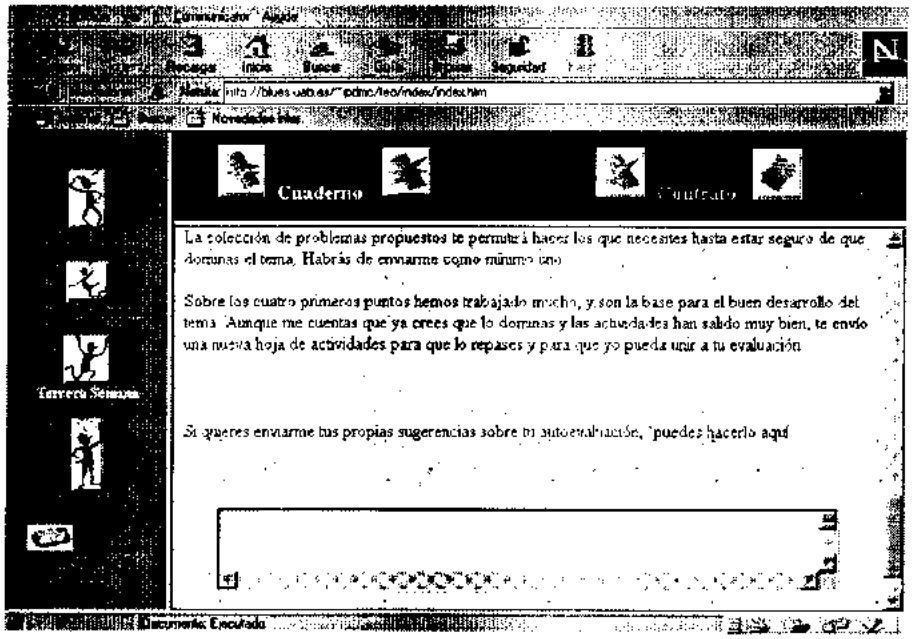

Figure 1: The icon labelled *contrato* open the page showed in the bigest frame. There, the tutor opens a space to make explicit to the student some information concerning the points for evaluating the student's work. The use of dialog boxes in this page shows a key to negociate these points with the student.

Personal invitation
The environment adress to the particular needs of one student

Attention to strain
The particularity of the situations we deal with could make the students percive the experience as another factor for tiredness. The open possibilities of the internet are used to let them move aside the planned contents.

Spaces for tutor and student interaction.

To anticipate possible blocks on the student activity, different levels of help on the proposed activities are included.

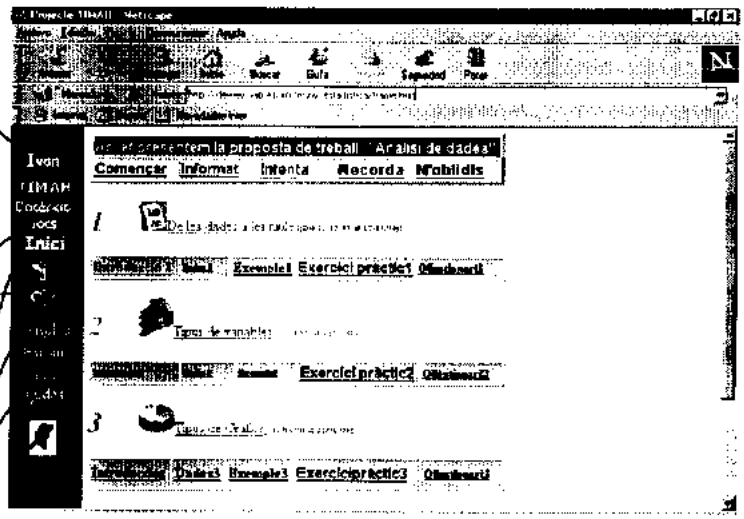

Figure 2: Open session planning: From the beggining of the experience, the student knows that the environment is modified depending on his/her rythm.

Design of the tutorial units and adapted curriculum

We have analysed some crucial aspects of a unified model of conducted-at a distance tutorial concerning several experiences with secondary students. It is important to emphasise the differences between this kind of precise support for some students, and general courses designed totally to be carried out at a distance, specially what concerns to design, evaluation and implement (Muria et al 2000). In the sections above, starting from some researches on the cases conducted in the project we offered the main points to be taken into account in the planning phase: contact with the family when appropriate; sharing from the beginning the initial rules and objectives to take into account; and flexible -collaborative, personal- design of the virtual learning environment.

But attending the end of the experience, it is more important to ensure the students' rejoining the school setting and the adaptation to the way of assessment of his or her current teacher at the school than evaluate the goals or benefits of the distance environment alone. We have detected that new habits of reading and writing, offering of open responses due to the asynchronicity of the distance conversations; and creativity arising from the contact with a virtual environment contribute to shape the learners' experience after the tutorials. Concerning the cases we are discussing here, this led us in the future to evaluate which of the interactive issues arising in the experience of learning at a distance are used by the students once they came back to their classroom setting.

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BRAZIL UNDERTAKES AN "INTERGALACTIC COMPETITION": A CHALLENGE FOR DISTANCE EDUCATION

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Distance Education And Entrepreneurship: A Methodological Focus

The great availability of knowledge and information made possible by the evolution of the new technologies for information makes it urgent to discuss models that can organize the Distance Education (DE) and that, concurrently, propitiate a broadening of the perception both by the student and by the teacher. The present reality demands the formation of potentials, of creative individuals who can solve problems, who are independent, autonomous, flexible and cooperative.

Such a scene invites the culture of DE to become compatible with the culture of entrepreneurship, specially in relation to the production and construction of knowledge based on the development and updating of traits which capacitate the professional so to make him adequate to the needs of the present profile. After all, this is the main goal for those who seek for educational institutions.

The profile of the entrepreneur is perfectly adequate for the changing, fast, uncertain and challenging environment since in addition to being adaptable, the entrepreneur is able to create value for himself and for society at large with a decisive role in the culture, in the values and in the social behavior of any organization (Pereira, 2000). However, the value of such a profile seems to be exactly in the difficulty in achieving it, considering that it implies a change of habits, customs and mentalities already deeply rooted due to the usefulness they once had, but which they don't have anymore (Bandler, 1982).

The relations in the "Virtual Classroom", which make possible, for the first time, the face-to-face DE, must allow an open and flexible learning mediated by telecommunication. The traditional educational environment can finally be transformed because the "distance" does not appear as the most important parameter, but rather the mode of the communication that is going on. In that sense, the new generation of DE requires abilities to "make connections among people" and resources of communication technologies applied to objectives of teaching-learning (Collis, 1995:09).

The challenge of keeping pace with the speed of change requires an attitude of simultaneous and continuous learning from teachers and students. Teachers must update both "(...) the knowledge of their specific fields of teaching and their pedagogical competence" (Levy, 1995:05). The rhythm and the urgency of such an updating may vary according to the age, profile, and context of the students, but the reciprocity of learning becomes continuously more indisputable in accordance with the current educational approaches.

Papert (1994) alerts one about the relation of the child with the machine, arguing that the construction of knowledge is better made by beginning with the discovery of what they need, and that such a disposition keeps them motivated to continue their search. Theoretically, everything would make one think that the same would happen with the adult, but in practice it becomes more difficult when the process involves those who were not educated according to such a perspective of learning. Thus, the adult, both teacher and student, in contrast with the child, exhibits a resistance to be overcome both in relation to the new technological media of communication and in relation to the new modes of perception of the world made available earlier to the younger ones.

To create new mentalities, behaviors and attitudes becomes ever more necessary for survival and success both for organizations and individuals who need to adhere to continuing education in all levels (ENE, 2000). This is true specially for knowledge institutions who seem to be the moving force of economic development. It is necessary, Dolabela (1999) claims, to disseminate the culture of entrepreneurship because the priority does not reside any more in the tools, but in who is able to create them (BABSON, 2000).

In order to undertake innovative learning relations in DE by videoconferencing that are capable of surpassing the "*talking heads*" (Cears apud Cruz, Pereira e Moraes, 2000) it becomes necessary to exert emotional and cognitive abilities by means of motivational procedures, which in addition to shaking up prejudices can activate a behavior based on a willingness to learn and to innovate constantly with creative solutions.

As an imaginative game, science fiction can function as a cognitive road to self-fulfillment as it loosens conventional ties stimulating the mind for creative achievements of learning and reflection.

In his trilogy comprising *Foundation, Foundation and Empire and Second Foundation*, awarded with a Hugo[1], Isaac Asimov shows the evolution of a historical crisis in an immense human galactic empire. His artful mixture of information and dream in science fiction has influenced innumerous scientists, who found in his stories the inspiration for making modern science. Marvin Minsky (1993), the American who is considered one of the founders of Artificial Intelligence, claimed that Asimov's stories of robots illuminated the possibilities in the future, and after reading them he never stopped thinking about ways to build thinking robots endowed with common sense, intuition, a conscience and emotion, and about how the human mind does all those things. Carl Sagan, astronomer, professor at the Cornell University in the United States, and another outstanding science divulger, was also an avid reader of the intergalactic adventures narrated by Asimov, and became his friend in the early sixties, together with Minsky. Leon Lederman, the Nobel prize of physics in 1998 and a professor at the University of Chicago, is another scientist who acknowledges a great influence from that author over his professional life. Joseph F. Engelberger, the president of *Unimation, Inc.*, from Danbury, and in charge of the production of robots initiated in the fifties, claims that he decided to devote his life to such a profession because he used to read Asimov's stories when the author was his schoolmate at Columbia University.

Asimov is considered not only a fiction writer, but a visionary who popularized knowledge and influenced science itself while writing on almost all fields of knowledge. He explained what is a black hole, what could be the most dense existing bodies, he talked about the exact value of *pi*, the ratio between the circumference and the diameter; he taught the nomenclature of organic chemistry and discoursed on the number of heartbeats throughout the life of a cat.

In *Nove Manhãs* (1971), when pondering fictionally on professions in the future, Asimov stresses creativity as a rare ability in a human being from a technological society highly developed. The very ability to learn in such an era was limited by a repetitive behavior. A number of other planets participated in the Olympic Games that were taking place on Earth, in which human professionals were the competitors and had their performance assessed based on criteria which took into consideration the quickness with which the answers were given using only a mechanical kind of knowledge. Reflection and the ability to create and evaluate constituted rare talents owned by only 1% of the population in the universe.

Because science fiction has proven to be such a useful motivational environment for entrepreneurs of knowledge and technologies and because one must consider Asimov's view in relation to the extinction of certain abilities the Intergalactic Competition was organized. It's aim was that of activating new attitudes and creative answers for learning relations in DE, and it was designed to be applied in the disciplines of MA courses in Media and Knowledge, with an emphasis on management of the use of computers in education.

The Competition: Rules For Learning In Distance Education

The discipline of Distance Education deals with open learning systems, Distance Education and formal education, institutional and course models. It deals, too, with the concept of media integration, operational structures, and planning and construction of models for Distance Education. The institutionalization of

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[1] Hugo é o prêmio mais cobiçado da Comissão Mundial de Ficção Científica. A trilogia foi considerada a melhor série de ficção já escrita. Asimov recebeu ao todo oito prêmios de alto significado como reconhecimento público.(**Super** Novembro, 1993. Ano7, n 11)

Distance Education in Education and the existing models for distance universities are also included, as well as the emerging media and trends.

The methodology employed in Distance Education workshops emphasizes the construction of knowledge by means of creative and cooperative groups in a motivational environment planned according to group techniques and exercises for individual memorization.

The Intergalactic Competition offers the motivational environment by switching the class to a fictional context in which the intelligent groups of Earth must face the challenges of the universe. In order to obtain the title of universal citizen, the earthlings work in multidisciplinary groups to reorganize information with the objective of affecting effectively target groups, who are considered different worlds facing the threat of the extinction of intelligent life in the universe.

Creativity and innovation, the search for information, communication, flexibility, autonomy and cooperation are the abilities that are practiced in the learning relations during the classes, which are planned with procedures for 11 meetings, among which seven are devoted to the competition of the IGs (intelligent groups), who follow the rules of the contest. Each IG must choose a vital target for the survival of intelligent life; identify the communication channel in order to hit the challenge target (sites for destruction of vital energy), organize an "influence system" (knowledge to be worked upon and transmitted); exchange information with other intelligent groups; assess the other groups as well as their own group in the meetings; and suggest modes of performance of "influence systems" for the groups.

The score follows the five criteria for valuing abilities and attitudes, which the groups receive in the first class. The value attributed to the group's productivity (1), for instance, lies in the ability for establishing empathy among differences, so the group must select a theme which is meaningful for all its members; thus, each group must be constituted by assembling professionals from different areas. In order to facilitate both the productivity of the group and the participation of the larger group an equivalent number of points is given to those groups who can make their material available in the site (2) before their presentation. To obey such a rule implies a gain of points in two items. Since the target public chosen by a group might be imaginary, it is important that the members have its profile at hand both for the feed back and to play the role of the target public. The feed back (3), which is anonymous, individual and included in the site in the same day also adds points. Thus, the IG of the following meeting can and should include the previous experiences in its performance in the competition. In order to stimulate exchange and cooperation points are also given to the IG who, after their presentation, distribute its members among the other IGs with the function of clarifying and detailing the planning (4) of their performance. Such a performance (5), planned according to the content in Distance Education, gets the same number of points of the other items, so that the success of the final product does not minimize the value of the attitudes and abilities displayed during the process as a whole.

The general goal for the intelligent groups is to optimize the individual intelligence by means of a "communion of interpersonal interests" for the sustaining of life in the universe. Thus, the Intergalactic Competition promotes a contest with explicit rules aiming that cooperation in which all profit and learn with multiple experiences and with specific knowledge which favors the interlocution among the diverse fields of knowledge.

Results In Constant Assessment

The Intergalactic Competition, inspired in Asimov's (1971) Olympic Games, is planned for the practice of abilities in entrepreneurship and to update the profile of the distant student who lives in a technologically advanced society. After all, if the differences between being awake and being asleep can be questioned (Llinás and Pare, 1991), and since there are no differences in the neuronal bases which are responsible for those two kinds of state, and if these two states share a common basis with the oscillation of groups of neurons at the 35-45 MHz band, then why not take profit of the neurological and functional similarities between dreaming and perceiving? If there is a lot of perception in the dream, then perception is also very close to the oneiric state.

To cooperate in a highly competitive and mutable society, meeting the needs of the profile of the present day professional who wants to update his knowledge can be as difficult as it must have been to meet the needs of the profile for the "eternal bondage" characteristic of the Middle Ages (Pereira, 1993). The complexity of being a "boss" in a world of "bosses" (De Masi, 1999) requires the practice of abilities which broaden the perception of the adult. That is why the Italian author points in his research the "creative groups" as an important trend to be explored. The challenge is to create "(...)*prepared and motivated teams who determine the fate of the most notable ventures*". (Id., 1997)

The technique, exercises, dynamics and experiences made adequate for classes by videoconferencing with support in the Internet take profit of the contents and tools of Distance Education as challenges for the current trends. The testimony of the students that follow serve to illustrate the significance of the methodological innovations for the production of updated knowledge. They say:

- "The initial suggestion made by the teachers and included in the 'motivational environment plan' propitiated a three-dimensional view for all of us of the contents proposed: Analysis of the proposed contents in the bibliography; personal contribution of the groups and an outside view, another dimension, another planet at a distance (...) The classes in Distance Education offered us new information by means of cognitive processes in the use of the available bibliography, in a process of democratization of the information utilized in diverse tools for communication. (...) In this discipline we could learn and undertake regional and global solutions in Distance Education." (R.E.S., 1999).
- "(...) when we started we were uncertain and showed some resistance and anxiety (...) we were unsure if Distance Education would attract us, if we would have in the 'virtual classroom' the same warmth, the same emotion and the same results of the 'real classroom.' ... There is nothing more innovative for the breaking up of the paradigms that Distance Education..." (P.R.R.S.,1999)
- "*I've learned a lot with (...) the system of work presentation by the different groups in a methodology valid and very pleasant (...). Each group tries to do better than the other and that 'competition' (in a good sense) brings only advantages.* (T.C.M, 1999)
- "The procedures of Distance Education have enriched and broadened our knowledge (...) the close companionship and exchange experienced with our colleagues has brought us a perfecting of creative and dynamic ideas. By contemplating our procedures we can synthesize the dynamics that was offered by the teachers of the discipline of Distance Education, who proposed with ease a work turned to a second dimension and which proves that even at a distance it is possible to communicate, to transmit (...) even at a distance we could create, invent and discover paths for us to relate with one another."(M.A.C.F., 1999)
- "Many times the fact that a fictitious situation was established (...) to function as a starting point to work on the concepts at issue awakens the students' interest together with a sense of responsibility for the situation, interaction and incorporation of knowledge, which occurs in a natural and pleasant way." (C.O, 1999)
- "Another important point that we could observe in Distance Education was cooperative learning, the interaction teacher/student, student-teacher with positive impacts on learning (...). The teachers' idea of creating a motivational environment allowed us to experience a situation which resulted in the high quality of the works presented." (V.P., 1999)
- "I'd like to congratulate the teachers for a wonderful job (...). In the integration of the media it was shown that many people, from a number of places assemble around a common ideal. The more the people get involved the better will be the result (...) what seems to be a typical situation in Distance Education, and the lesson we keep is that we can make such an interaction of media and achieve better results: Far is a place which doesn't exist (...) there is no distance for emotion." (I.V.P.O., 1999)
- "The example offered at the UFSC is being gradually followed by other universities and changing the negative opinion on Distance Education, conducted with seriousness, adequately planned, with the use of updated media of communication, and with motivation and an adequate assessment. That course has become a landmark in our lives, of companionship, friendship, social and technological development, not to mention the perfect faculty-students integration. Such an excellence in teaching can be confirmed by the presence of 100% of the students in the course after a year has passed by.

The continuing assessment of the quality of the courses by the researchers of the Laboratory of Distance Education (LED), the attention given by the researchers at ENE to the necessary innovations in the behavioral repertoire and to the necessary profile to face the present challenges has shortened the distances and added value to the produced knowledge. The emphasis on the learning relations faces, in videoconferencing, the challenge of overcoming the "talking heads" both with the teachers and with the students.

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DIGITAL RESOURCES FOR EDUCATIONAL SUPPORT

Serge CANDOR, CNED (France)

All studies concerning distance learning and training have stressed the role played by "loneliness" or "isolation" as reasons for dropping out, and this is more pronounced the lower the educational or qualification level of the trainee is. It is difficult to learn without support. Educational intermediation can be seen as the significant aspect in teaching, including for distance teaching where it is the factor distinguishing the latter from self-teaching.

Pupil guidance therefore appears as a vital element if not the most important element in most distance learning systems. However the guidance function is not necessarily synonymous with a presence-based relationship between the trainer/tutor/tutor/teacher and the trainee. Digital technology can allow for and facilitate new forms of tutorial, both at distance and asynchronous. It can also be used to complete and prolong the traditional teaching activities precisely because it makes it possible to go beyond the constraints as well as the spatial and temporal barriers on which these are based.

As part of the public services mission conferred upon it by the Ministry of National Education, the CNED has developed a certain number of academic training activities using digital media for pupil guidance or for the support of presence-based teaching.

Assistance and pupil guidance as part of distance learning.

The repeated requests from trainees enrolled in school education for presence-based support in the form of groups or individual monitoring as well as the need to meet the requirements of a large number of students have led the establishment to consider substitution methods. Indeed, excepting the case of highly specific target groups (for example the disabled who receive pupil guidance at home) and excluding particular activities (reception sites of television broadcasts produced for certain training courses) the CNED does not have a network of support or resource centres organised around a presence-based system. The constraints posed by distance in pupil guidance activities have been a key feature when examining the subject. Thus, in a pragmatic manner and in conjunction with the increasing integration of tools in social practice and educational usage, the trainers from our establishment made use of the telephone, and then of the Minitel. For the former, the usage could not be more traditional, putting a pupil in real-time contact with the teacher concerning a particular question the pupil may have. The Minitel made it possible to introduce new forms of teaching relationships, including forums of students, collective questioning and asynchronous contact with tutors. These initial activities as well as the need to face up to changes following what can only be called a digital revolution have led the various educational teams to think more deeply about the use of new tools in training activities and to put the emphasis on two main points.

First of all, it is "important to remove an ambiguity that can be seen in certain discussions on the matter : it is not the technology that supplies the educational innovation. The educational project comes first and uses the technological tools to its own ends. Next, it is necessary (if one wishes to make available relevant distance support an pupil guidance procedures), to get away from the conventional model of the teacher/pupil presence-based relationship which has the consequence of completely transforming the lecture function.

Pupil guidance or support activities have therefore been developed with the aid of digital media, initially centred on the course contend. The national center of distance education has developed summer courses, support CD Roms in mathematics and French, improvement and support exercises on line, and online pupils guidance sites.

The administration of the sites has highlighted certain constraints and has made it possible to give greater thought to pupil guidance, in particular within the framework of the establishment's training school. First of all, and particularly at that level of schooling where the pupils have not yet entirely acquired full autonomy in their learning methods, the demand for assistance takes several forms. It is both a matter of giving pupils practical and administrative information, helping them in the material organisation of their

work while at same time helping them regarding the absorption of the content and the methods. This requires a new positioning strategy of the teacher/tutor or rather different functions to be carried out by the trainers. Indeed, it is necessary at the same time to manage the pupil in all their work, (a role similar to that of the head teacher) and to help them individually in their learning process, requiring an approach that is both disciplinary and methodological. In as far as even in the work is carried out in an asynchronous manner it is not possible to have all of the human resources needed, a new educational approach drawing upon experience gained and upon the standardisation of approaches and pupil errors is necessary, which profoundly alters the role of the teacher when he becomes a tutor. This work is currently underway at a middle school level.

Educational support after school

Still within the framework of the use of digital technology for educational support, a project is currently at the planning stage with the ministry concerned, aimed at cycle 3 elementary an middle school pupils. For the establishment, this involves extending its public service mission and being present in a sector that is for the time being exclusively occupied by the private sector. The scheme and will involve relay-teachers, made available by the parent ministry for this operation and the development of services in the most diverse places or forms (from groups of pupils in the classroom after school hours through to individual homework assignments).

This project can be broken down into three levels of services or possible actions to which a fourth special service may be added.

The first level involves offering those pupils who need it specific, up to date, and immediate responses, "helping the pupil right here, right now". It involves putting the pupils enrolled in this department in contact with a teacher other than their own who replies "live" over the web or by telephone to questions concerning the difficulties encountered by them with an exercise, an item of homework, an area of the programme, etc., and provides the possibility of consulting special modules and informative resources concerning working and biological rhythms.

The second level provides the pupil with the methods to resolve the problems that he encounters "helping the pupil for tomorrow". This involves enriching educational practices through the identification (on a level-by-level and discipline-by-discipline basis for a given exercise in the scientific area) of the various ways possible to reply to the question set, which will be proposed to the pupils. The work is aimed at helping the pupil to acquire sound working methods.

The third level involves providing the pupil with refresher exercises or guiding him towards support products. This is a more prescriptive approach, which requires a whole range of remedial exercises. Moreover, cooperative work between pupils via the web will be encouraged.

Regarding the fourth service, this essentially concerns English at a primary level and is aimed at putting the pupil in a genuine oral communication situation (by telephone) or a written communication situation (by Internet) with priority being given to spoken skills.

Digital resources serving the new open classes

"The virtual classes" can be used as an additional resource for French schools abroad. Briefly, this method includes a school-type organisation, and a multimedia environment and services.

The school-type environment: this involves creating an "educational community" with a group of 30 to 50 pupils at the same educational level and with access to the networks. This group has similar referents. Naturally the content of the training, but also the team of tutors/trainers.

The multimedia environment means access to the resources (even to databases), the availability of content and tools, in the largest sense of the word, and in particular conceptual or browsing tools. This is a condition that is not sufficient but necessary. Access to ever richer and more numerous resources, over and above the intrinsic requirements of the request, creates an extremely favourable learning environment.

As for the services, these are of two types. First of all there are there are those services related to technology (electronic mail boxes, discussion forums, etc.) that have the main role of promoting communication and virtual friendships. But also, (and above all) there are educational services and communications (electronic corrections, organisation of forums, electronic tutorials, learning assessment, guidance for trainees, and communication with real classes working on the networks). This system allows for interaction between the dispersed members of a class and their administration, with cooperative exchanges based around a theme or activity, educational steering through a group of trainers (with differing functions), educational project that is clearly identified and shared by the various persons involved. Naturally, this scheme can only develop in an environment where computer tools are effective and fully understood. But the essential feature of the virtual classes is to be found above all in educational situations, as these classes only have a genuine educational meaning when those using them succeed in going beyond simple informal and cooperative discussions in order to reach typical educational school practices.

The development of these systems is mainly taking place with the schools of the AEFE, generally benefiting from high-performance equipment and open minded educational management staff (playing a key role where pupil guidance is concerned), and above all a parallel school structure which makes regulation possible and where we find pupils keen to escape the isolation of their reference community. The initial feedback at the end of six months of operation has corroborated the preceding remarks. Digital technology makes it possible to go far beyond the walls of the school and school hours, while at the same time remaining at school. The lecturing function has been radically transformed by this system and the teacher changes his role when he becomes a tutor. The operation of this system once again leads to a re-examination of the overall administration and the training of the trainer/tutors.

And what about teachers training ?

The true integration of digital technologies into his usual teaching usual act, which is actually necessary, infers an important inflexion to the teacher training. These technologies have became as a new area of the formation, putting in tension the three vertexes of the usual pedagogic triangle. At last, and this is an important point we have to not forget, training must integrate the evolution of the society and must promote some values, in spite of the technical skills, values which have to show through the teacher's daily work.

The teacher of to-morrow will not be a simple dispenser of knowledge, or a social worker, or a socio-cultural organizer, or a simple tutor, even he can perform these functions for a time. First of all, he will have to be, more than ever, a professional, a technician of pedagogy. Teaching is a job, not an art, with high responsibilities. Secondly, the teacher has an important social function. He is a citizen, but a citizen who has to promote an active form of citizenship, from values he has to live out in his professional act.

So, the teacher of to-morrow...

He will have traditional teaching functions : to teach to the pupils how to learn with learning something ; to provide them with basic skills (to read, to talk, to write, to count..) ; he will have to work with the others in teams with all the school partners.

He will also be a regulator. He will have to bring some unity and a kind of regulation. The means : hybrid teaching where digital technologies are used for opening the field of the classroom and of the school. The sudden emergence of these tools in daily life found a huge education market ; it breaks unity of time and unity of place in the teaching act. And this is perhaps abreaking point in relation to the teacher of to-day. It seems that he will not only work in a school, but differently and in other different places, and not only with pupils in face to face.

Conclusion

Distance learning owes its existence to its role as an alternative or a supplement to traditional education governed by the famous didactical triangle with three peaks on which we find knowledge, the teacher and the pupil.

These technologies upset this traditional positioning of distance learning, which can prolong, support and enrich traditional forms of education and training. They also undermine the conventional geometry of the educational act in radically changing the lecture function and diversifying the means of access and the relationship to knowledge.

Used for educational intermediation ends, these tools can allow for a new form of administration of learning methods and an alternative understanding of forms of education where absence and presence are perceived differently. They contrast two functions, those of the tutor and those of the teacher, who must exist side-by-side and even work together, but for which, for the time being, we do not always clearly perceive the dual nature and the consequences that they generate in terms of identification and training.

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TRAPEZE: USING A TWO-WAY SATELLITE NETWORK FOR EDUCATION PURPOSES

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Abstract

The Trapeze project has built and demonstrated a satellite tele-education service for travelling people like those in bargee, circus or fairground communities. Due to their mobility, these communities do not have access to fixed or high bandwidth wireless communication lines. Trapeze provides a 2 way internet service over satellite which is also particularly suited to those individuals, communities as well as schools and educational institutions who, because of their remoteness or mobility, have difficulty connecting to the Internet via the traditional means like telephone connection, ISDN, ADSL, Cable, etc.
The Trapeze project, supported by the European Space Agency, has recently completed a successful 5-week trial that linked pupils and their teachers in the Netherlands and the U.K. using this unique broadband satellite supported network.

TRAPEZE: the project

The Trapeze project is supported under ARTES 3, the European Space Agency's Multimedia Initiative as part of their commitment to the use of advanced European satellite developments in education.
Partners are:

- European Federation for the Education of Children of Occupational Travellers (EFECOT),
- @iT a Belgium-based audio-visual technology, informatics and telecommunications company specialising in the field of telematics supported learning,
- Telespazio, the Italian satellite service provider owned by Telecom Italia,
- Two schools, the Stichting Rijdende School in the Netherlands and the West Midlands Consortium – Education Service for Travelling Children in the UK,
- Audio-visual service of the Katholieke Universiteit Leuven in Belgium.

The Trapeze project began on the 1st of November 1999. The main components of the project included:

- The development of the telecommunications platform,
- Defining and building the learning environment,
- Developing the course materials,
- Trials,
- Evaluation and consolidation.

The project was aimed at a limited group of travelling and highly mobile learners in the UK and in the Netherlands. The trials involved 6 tutors and 20 learners using a total of 22 workstations,[1] and took place between the last week of May and the end of June 2000. The Dutch trials lasted five weeks and the UK trials started one week later because of school holidays. The children involved were all in the age grouping 8 to 13 (with one 14 year old Dutch learner). The focus in the UK was on the younger end of this age range, and in the Netherlands on the older end.

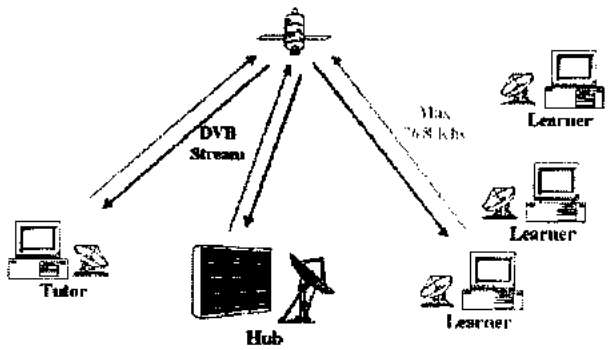
[1] The Dutch tutors worked as two tutor-pairs, each with a single workstation and each pair looking after one group of children. There were 18 learner workstations; in two instances, brother and sister both used the environment independently and participated fully in the trials. (Some younger siblings also received some separate materials and support.)

All the children taking part in Trapeze are from fairground families who normally travel for 8 or 9 months each year from fairground to fairground. As a result, the education of these children can be severely disrupted as they depend on occasional visiting teachers and work-packs to do their schoolwork between teacher's visits.

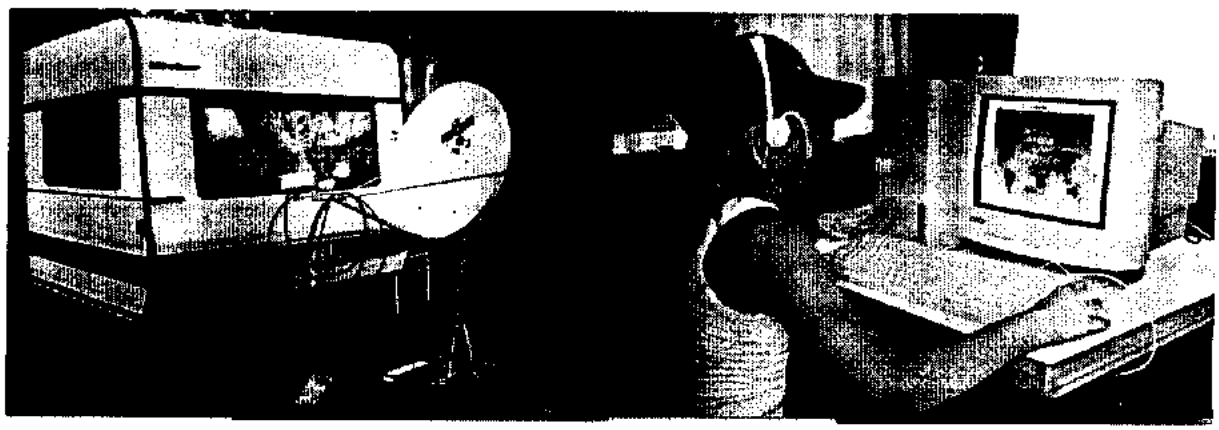
The Trapeze project faces 2 substantial challenges. First, the implementation of an innovative 2-way satellite system with highly mobile users. Apart from technology issues, regulatory issues need to be solved to meet this challenge. The second challenge lies in assembling a learning environment, based on existing tools, that is sufficiently attractive for institutions involved with traveller education to integrate that Environment permanently in their teaching practices.

The telecommunications platform

In general, satellite-based communication systems focus on broadband one-way communication. The return link is usually established via terrestrial lines (dial-up modem connection via telephone line, sometimes via ISDN). Within the Trapeze project, satellite technology is utilised for the return link too, making use of the KU-band. The connection from the Client stations to the Hub is made possible by a transmit-receive antenna system. The Client dish itself is low-cost and small.



It is the first time such a system based on state-of-the-art VSAT technology working in Ku-band has been used in such a way. This innovative technology allows for *2-way high-bandwidth interaction* using small end-user equipment (98cm receiving-transmitting dish). The multimedia information downloaded from the hub station in multicasting mode can reach 3Mbit/s with a return channel operating at 76.8 Kbit/s from the learner station. The network can be used in a number of different ways, for multicasting large amounts of data to remote stations as well as for interactive receipt and transmission of audio/visual files, for messaging, for synchronous 'chatting' and for surfing the Internet.



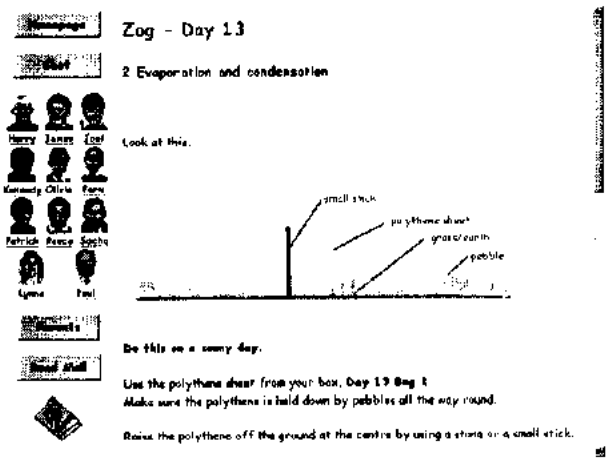
This leading-edge technology offers the ideal solution to build an educational service for dispersed and mobile users to transmit large information files, be it data, video, audio, or graphics. The Client PC can be a single workstation or consist of a gateway, providing network access to other PCs over a LAN.

The learning and teaching environment

The process of agreeing a learning environment took place over a period of time to allow tutors to base recommendations on perceived user needs and to allow the project group to explore the art of the possible. In the event the tutors fairly quickly chose an on-line, virtual-classroom approach with new learning materials to be sent to children each weekday morning, along with feedback about their previous day's work and other messages. During the morning 'classroom' sessions tutors were to be available through a chat facility, which could be used on a one-to-one tutor/learner basis or within the whole class context. Email was also to be available, and could be used for private communication between individual learners as well as for the tutor/learner link. Tutors also suggested audio- and videoconferencing facilities, but it was not possible to identify sufficiently robust and cost-effective software for the trials. The other key feature of the environment, as requested by tutors, was an easily activated return link, which could transmit the results of exercises and other completed work, so that they could monitor, prepare and provide feedback on a daily basis.

Developing course materials

The identification of learning materials also took place over a period of time. SRS based their selection, to an extent, on materials already used within their Mobile School system. However, the West Midlands tutors did not have a similar base-line and needed to agree a selection of materials suitable for a one month trial period, and which would complement the traditional work-pack activity of their learners. The agreed SRS materials covered three topics 'Maths', 'Verbs' and 'Science'. The West Midlands also chose to cover 'Maths', and then focused on a mixture of 'Science', written work and investigation, mainly through the introduction of a fictitious planet called 'Zog'. The total size of the content of the English learning materials was about 85 MBytes and for the Dutch learning materials, about 35 MBytes were allocated. The difference is because the English teachers used more video and audio within the learning contents.



Screenshot of typical learner's content page.

The process of identifying topics and general learning objectives was relatively straightforward, but was only a precursor for the challenge of identifying materials, which could be modified or transposed into the interactive web-based format, and indeed of creating new ideas. For the purpose of the trials, it was necessary to produce materials within a short space of time, and a small team involving the tutors, using standard web editing software such as FrontPage and Dreamweaver Coursebuilder, undertook the modification/transposition of the main bulk of materials. Few learning or software tools were adapted or even developed (Webdraw) for specific applications within the learning environment.

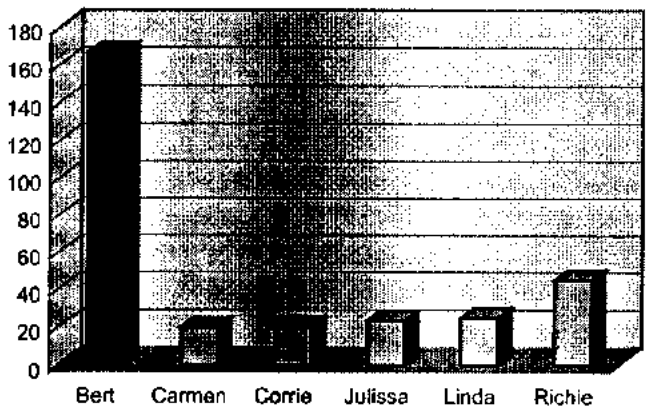
Training in the use of FrontPage as a HTML editor was provided, to allow tutors to manage, modify and add to materials during the trials as they assessed individual learner progress.

The trials

The other major preparatory activity centred on the children and their families. Tutors used a mixture of individual and group meetings to familiarise parents, and similarly to give the children (where necessary) basic ICT skills training relevant to using the Trapeze learning environment: use of keyboard and mouse, pointing, clicking and dragging. This process was complicated by the trial context and it was not always possible to cover everything in the pre-trial period. Guidance on installation and using the learner interface had to be handled as part of the process of distribution of the client stations to the families.

What happened during the trial was that whenever the travelling family arrived at a new fairground one of the first jobs they did was to set up the Trapeze satellite dish and plug in the computer. The child taking part, often accompanied by his/her brothers and sisters, then checked to find their latest schoolwork and messages from the teacher and other pupils. They then took part in a 'virtual class'; *a learning environment that allowed synchronous communication* with their teacher and other pupils. During the virtual class, they are able to access the multimedia learning materials prepared by their teachers, carry out various tasks and activities with these materials and return their homework and results directly to the teacher so they can be monitored. They can also 'chat' online with other children from the same class as well as their teacher and participate in interactive collaborative class-work using the system. All materials and content for the pilot is housed in a secure, centralised server which only allows the children access to the sites and materials which have been chosen by their teachers.

During the trials a total of 1.55 GBytes were transferred over the network[2].



Traffic in MBytes for the classroom of teacher Bert (NL)

Evaluation

The system performed extremely well during the trial period allowing children to interact daily with others in the network. It also allowed teachers to correct children's work and set new individualised work programmes for each pupil as well as allowing children and their parents to surf the Internet for interesting and fun sites. Parents and teachers alike saw the Trapeze learning environment as being a major step forward in allowing their children work at their own pace in a disciplined way. The combination of computer-based materials and tutor 'presence' albeit virtual was seen as *a significant motivational improvement that provided immediate feedback and clarification.* As one of the parents said at the end, "Sacha had done much more in the Trapeze learning environment as she tends to 'drift' with the (usual) workpack rather than being engaged". Teachers and learners report that they covered far more work than they would normally when depending on visiting teachers and work-packs. The quality of this work was also agreed to be significantly higher and the use of this system was viewed as a "big improvement in terms of encouraging effective learning activity". The families were very excited by the

[2] Over a GSM network, this would have constituted a total connection time of over 350 hours, or an average of about 16 connection hours per user. This represents a cost of about 190 EURO per user per month.

possibility of "having a school at home" holding out the prospect for the first time of *an effective educational provision for their children.* Obviously, the trial also ensured a significant improvement in the children's computer skills with many of the children learning for the first time how to use a computer for learning purposes.

The Trapeze learning environment is not intended to replace the teacher or traditional learning resources like books. Rather, it provides the extra stimulation and motivation travelling children seriously need to cope with their often isolated learning situation.

Conclusion

Practical steps are being taken to launch a service in January 2001 aimed not only at travelling children but also those responsible for *networking remote and poorly connected schools in Europe.* The system has also terrific potential as a way in which communities can be connected in less developed countries outside Europe. At a political level, the need to provide suitable and effective IT support to *all* the citizens of Europe is of particular interest. The Lisbon Action Plan, for example, makes reference not only to supporting isolated schools, but also to the dangers of 'info-exclusion', systems like those deployed within Trapeze can provide *a significant tool in overcoming such exclusion* as they allow for anywhere, anytime large bandwidth connectivity. Connecting an isolated school or community takes only the amount of time it takes to set up a satellite dish; expensive wire-based solutions[3] are no longer necessary. Speed, coverage and network availability of present mobile telephone networks do not compare to the service satellite networks can offer in underserved areas.

The Trapeze experience with the learning environment is not exclusively linked to the typical technical platform of the two-way satellite network but requires an acceptable bandwidth IP capable connection. The learning environment can therefore easily be transferred to other present or future networks such as ISDN, Cable, ADSL, UMTS and other emerging mobile and satellite networks.

More information on: http://telecom.estec.esa.nl/artes/artes3/

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[3] The cost of providing ADSL to island communities off the English coast is estimated to be on average about 750,000 EURO.

E-EDUCATION AND LEARNER SUPPORT: A NEW APPROACH

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Introduction

At the Budapest conference in 1997 (1) we presented our research programme DESCARTES (Developing Educational Systems Comprising Applied Research and Technology Systems). DESCARTES focuses on research for new learning architectures, based on Information and Communication Technology and is dedicated to the central theoretical problem: *"how do people learn better"*.

The support system MATHESIS (MATH Expert System for the Information Society) was announced then as an example of our research programme and a prototype of this system has been shown at the Bologna conference in 1998 (2). Testing under real world conditions has been undertaken in 1999. Also in 1999 we started upgrading this support system towards a *generic support system* for all kinds of content learning materials. Dutch language learning is now on it's way. Other content materials will follow.

This school year the support system will be presented to all secondary schools and universities with the aim of stimulating teachers, learners and students to participate in 'open source communities' and helping us to create the necessary content for the school curricula of mathematics and Dutch language.

In this article we focus on some recent emerging problems concerning the transformation from traditional classroom education towards tomorrow's schools under the influence of *e-education*. It will be shown that these problems are related to the main tasks of education in the school and at home: *knowledge transfer and competence enhancement, social-emotional development of learners* and *allocation*. These problems have simultaneously to be taken into account. It is to say that our system has also to incorporate *supporting both the learner and his environment in his social and emotional development*.

The headlines of our approach on integration of personal development into our support system for subject learning are given. Details will be presented at the conference.

Enhancing the impact of e-education

There's still little evidence for the prospected impact of e-education on all-day practice in schools and classrooms. Instead of the expected acceleration in the transformation from traditional classroom learning towards new and open learning environments, this transformation process under the influence of e-education seems even to slow down in some areas. As recent evaluations show (3), many species of e-education, once introduced in the classroom and in the school curriculum become obsolete in due time.

Despite the nation wide implementation of up-to-date computer networks in the schools, a growing number of self-paced electronic learning materials, virtual teamworking of learners and an overwhelming flow of information available from the web, results aren't very impressive yet. Obviously more is needed in changing the educational system in order to improve learning results and to better prepare the learners for their participation in the information society.

Many reasons for this slow transformation process can be mentioned. One possible reason is of particular interest for our research group: many e-educational software products are apparently of limited use in the school curriculum. We noticed from the beginning that such e-educational *add-in* software never should have the power to significantly improve either overall learning results or to bring 'openness' in common classroom practice. Much can be learned from the introduction in the seventies of video or audiotapes in the classroom. Or long before: the introduction of books and all kinds of written learning materials. The classroom as such has always survived any attempt to realise more openness.
We postulated at the very beginning in 1995 (4) that an integrated approach in supporting the learner in his own school curriculum might have the potentials of bringing about significant change. So we started the development of a learner support system containing most of the existing school curricula *and having the potential to replace* (most of) the traditional classroom education including the e-add-ins in use.

E-supporting knowledge transfer and competence enhancement

Construction and validation of our system is under contract by the Ministry of Economic Affairs since 1996 and have to be realised before December 2001. The system has been described elsewhere (2) so only some main features relevant for the subject of this article will briefly be mentioned.

Integration into the curriculum: the system is offering automated support to learners being involved in their own school curriculum. To begin with a curriculum for mathematics and Dutch language learning at the level of secondary education.

The learner who asks support for his school tasks should be engaged in just one unambiguous learning path. So integration of school curriculum and support system, including intermediate and final assessment tests, is needed to some extent. Since integration should be tailored to the specific needs, competence and style of the learner and since all curricula differ from school tot school in content, sequencing and methods, the support system is designed to ongoing processing context bound information in order to refine tailoring standards. It has to be recognised that learner profiles dynamically change - not only as a result of learning. Also curriculum profiles may change in time. So any defined learning path should be dynamically adapted. For this purpose, the system is designed to process information, produced by both the learner and the teacher.

Cognition based learning for mastery: cognitive and psycholinguistic scientists involved in computer based learning, generally emphasise the importance of cognitive based competencies in learning. The development of such competencies, being basic to all other learning and personal development, should be a main target in education (5). However many learners seldom perceive 'how it feels' to have mastered a given task (to have solved a problem 'in the limit'). So support is dedicated to cognitive based learning for mastery.

Individualised learning: the more a learner is in trouble, the greater are his needs for external support in a one-to-one non-anonymous relation with a (virtual) tutor. This requires intake of the learner, establishing his competence level and defining appropriate learning tasks.

Learning anywhere: The learning materials and learning tasks are stored in a central database management system. A central server communicates with connected sites (schools and homes) and processes all user interactions with the materials and with learners and teachers. The system is designed both for on-line interaction and off-line interaction. In the latter case all local learner-system interactions (and the time in between) are automatically saved in a log file and uploaded to the central database.

Controlling progress in learning - assessment: Three main functions of teachers in tutoring are involved in control: continuously stimulating task directed motivation of the learner, immediate help in overcoming difficulties in understanding the 'how and why' and assessment. Since the support system is also aiming to function in the absence of any local human tutor, these tutor functions are implemented in a tutorial programme.

Learning problems and social-emotional status

This year we decided to review the concept of our integrated support system. Being initially technologically driven and smoothly supporting the existing school curricula - *the system should also account for the needs of learners where parents and schools fail to provide the necessary support.* The reasons for broadening our concept are the following.

The Dutch society is on its way to rapidly changing towards an outstanding knowledge and information based society. Consequently more and more people have to continually improve their level of competence in order to better functioning in a changing society. And the educational system is continuously challenged in providing the necessary support for all these people. But in recent years it became obvious that schools themselves were more and more in great trouble, in general by lack of means to keep on track with our rapidly changing society.

The educational system, in particular the school system seems to fail in providing the learner support needed. Recent investigations (6) shows that one third of the learners in secondary education and nearly 50% in vocational education are at serious risk of dropping out of the system. Two interrelated causes are held responsible.

In the first place many learners have serious problems with the latest curriculum reform, shifting from rote learning (memorising) towards cognitive competence enhancement (like problem solving behaviour) and from teaching towards learning ('learning to learn'). Lack of sufficient support on these topics at home as well as at school, and in combination with overloaded programmes, leaves the learner with many unanswered questions, provokes uncertainty and causes time-stress. Moreover, many schoolteachers, especially in the greater cities spend a great deal of their (already reduced) time in coping with social and emotional problems of their pupils - individually and in the classroom. This phenomenon significantly reduces the time available for coaching the learner.

Second, the mentioned investigations reveal that a much greater number of learners at risk suffer from mental disorders - about two times as high as hitherto assumed. Among these disorders are dyslexia, hyperactivity, anxiety to fail, depression, borderline and traumata. These disorders are likely to count for many learning and behaviour disorders like concentration problems, aggressive behaviour, badgering and truancy. These figures tell us nothing about social and emotional problems other learners might have, but it's not unlikely to suppose that 'we only see the top of the iceberg'. It's further remarkable that learners with a mental disorder (or a less serious mental problem) have normal intelligence. So intelligence as such doesn't play a role in their poor learning results.

Until now the overall policy in improving poor learning results in regular education consists of remedial teaching and additional practice. Underlying causes are in general not presumed, except in obvious cases for medical or psychotherapeutic treatment, often in connection with a transfer to special schools. Our support system is also dedicated to remedial learning for mastery, based on the assumption: *the more a learner is in trouble, the greater are his needs for remedial learning support.* This assumption still holds, but it implies neither that these learners will themselves take action for getting the support they need, nor that these learners are motivated or even be able to accept remedial support.

Evidence may be found in remedial teaching practise. It is well known that remedial teaching is most successful in an intensively one-to-one learner-tutor relation, i.e. private lessons. At the other side of the spectre it is also known that remedial teaching on a distance has very poor results. For instance the dropout rate from remedial software programmes without human tutoring are estimated to be as high as 90% within the first quarter of the programme.

These facts and findings make clear that additional means and actions are needed in order to improve our support system. If - for instance - a poor language competency originates from permanent concentration problems, more practise is unlikely to be effective. And if these concentration problems are caused by hyperactivity, concentration training will be of little help. In this case psychotherapy and/or medication (f.i. Ritalin) might be a better treatment.

Incorporating social and emotional development in the system - guidelines

In the initial support system teamwork, collaborative learning tasks and peer communication were already foreseen. According to accepted constructivist theories of learning, the enhancement of cognitive competencies of an individual should be a direct result of interaction in teams (Vygotsky, 1987). So social interaction is assumed to play an important role in developing *cognitive abilities*. Moreover *communicative abilities* are also developed in collaborative learning tasks and in peer communication. Our support system takes these findings into account and offers the learner a 'learning space', dimensioned by the following 'ability co-ordinates': *cognition, communication and content.*

We took these initial considerations as a starting point for incorporating social and emotional development support into the system, leading to the following additional guidelines to be implemented.

1. The intake test of a learner should be extended in order to reveal a more complete personal profile. A *personal problem record* is needed in order to take additional actions. The team responsible for the intake test should therefore also consists of professionals in the field of social and emotional problems, i.e. psychiatrists, psychotherapist and the like.

2. If intake test results indicate personal problems that are likely to prevent the learner from successful learning and personal development an advise should be given by these professionals;

3. If the personal problem record is not that serious the support system itself should offer opportunities to cope with these problems. The following additional support possibilities are under consideration:

   - coaching the individual learner (by a trusted representative);
   - parent counselling ('how to help my child being educated');
   - peer group monitoring (special subjects outside the curriculum).

Summary

Despite nation wide efforts to introduce e-education, little progress has been made until now. The main reason is the lacking of systems supporting the learner in his own school curriculum and able to replace classroom practice.
Since 1995 such an integrated support system is on its way. Implementation is foreseen within due time. Recent developments show that this system needs extensions in order to also account for the social and emotional development of learners.

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THE SCHOOL OF TOMMOROW. INVESTIGATING THE E-LEARNING PARADIGM FOR NATIONAL DEVELOPMENT

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Introduction

The new educational paradigm has been a common challenge within the national educational systems of the European countries. The tremendous development of the ICT's and especially the development of many distance learning, web based training and e-learning integrated platforms set a new base ground for exploitation but in most of cases this effort was limited on typical installations. The e-learning initiative of the European Union as well as other initiatives such Leonardo Da Vinci, EUMEDIS and IST expand the opportunities to research new concepts and to develop systems that will justify the key role of ICT's in the new millennium. This paper discusses and provides a new proposition, which combines theoretical concepts and technological requirements. The overall objective is to reveal the importance of e-learning pedagogy that is not present in the majority of the e-learning platforms. Our model for further analysis is called e-School and will be presented in detail in the following sections.

Current Situation. Experiences from projects.

With no doubt in the past decade we had the opportunity to use and to evaluate a number of technological innovations that made possible the delivery of learning content on-line and off-line irrelevant of time or place limitation. Looking at the priorities of such systems the conclusion is that the establishment of learning highways on the Internet was the first consideration. But after a few years of employment it seems that the Information Society has to offer a lot more than realizing a chat room, a bulleting board and a publishing on line mechanism. The new demanding areas for research and development are learners profiling, dynamic learning content reconstruction, and value discovery on learning processes as well as customized learning spaces. From the National Educational system perspective the above stated challenges and opportunities formulate a context for important debates, evaluations and decision. Furthermore the e-learning dimension of the National Educational Systems is not a buzzword but it is a concept for further analysis.

The analysis of the e-learning market in Europe is not only difficult but it has to be based on issues closer to effectiveness than to population increase. In most of cases the virtual universities, the e-learning systems base their functionality on a simple browsing mechanism accompanied with a section of web links and a few on-line quizzes. In other words which is the value of such a system when in most of cases the employment of the ICT is limited on the print button of browsers. We could state that these systems secure the growth of the so-called distance-learning marketplace in Europe even though the learner satisfaction from such a system is very limited. A critical question is can we enhance the learner satisfaction on an e-learning system or his first impression will be negative.

On a recent survey conducted on the Context of Teletraining Centre of Athens University of Economics and Business (www.teleduc.aueb.gr) most of the users of the "e-learning" system found the system limited due to its static nature (The system was supported from the traditional functionalities of a WebCT server). Additionally the trainers state the difficulty to prepare and to adapt the learning content on the specific content management mechanism of WebCT. Finally much of the effort was paid on problems irrelevant to the learning processes. One first conclusion from this survey is the need for the development of dynamic learning environments. A critical decision could be the formulation of a paradigm on which there will be specific variables capable to provide the dynamic nature of the new learning system.

An other example forcing our research effort is a project called Aristotle, a system based on WebCT supporting the diffusion of learning content for students of secondary schools in the field of Internet (http://larisa.heltrun.aueb.gr:8900). In this project five schools and about 300 students from many regions of Greece have an e-learning experience using WebCT. The main observed problem that the development

team face in the process for the creation of the learning content was the inability of the platform to support different level of knowledge abstraction and relevant learning templates. It was more than clear evident that the students would prefer a system on which the content could be organized on a different way than a sequential indication of learning notes.

Definition of the dynamic content of an e-learning system

Our research effort is trying to reveal the value of the learning processes that every distance learning system has to provide to each users. Figure one is a first try for the mapping and the definition of such learning processes. The distinction of ten specific learning processes implies different levels of technological requirement and consequently more sophisticated technological supported environments.

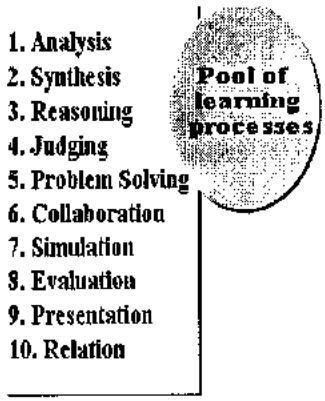


Figure 1. Learning Processes: A first variable for dynamic learning environments

Furthermore each learning process is a combination of ***learning tasks***, which jointly structure the learning space for the user. It would be really very interesting to define each of these learning processes in terms of related learning tasks in order to be able to adapt traditional learning content. These learning processes provide for the trainer of an e-learning system, the author, constructional pieces that can be manipulated in different manner according to different types of knowledge and problems. Of course it would be a lot more useful if we could incorporate this ability and on the learner side. Let's think about an e-learning system on which the educational space is dynamically created according to the preferences of the learner or through a discovery of required learning processes. In the projects that we mentioned earlier the basic disadvantage was the absence of mechanisms that would be able to test the students abilities to discover the knowledge.

The evaluation metrics in the majority of the e-learning systems are rather inadequate. The most challenging issue on our research is the detailed analysis of the learning processes from a logical perspective as well as from information intensiveness that are required to support the logic and the functions of an e-learning system. Consequently the detailed analysis of the learning processes will provide an overview of the necessary data elements and procedures. The object oriented analysis of such a system is not only critical for the success of the research effort but relates the students satisfaction directly to the necessary processes and data of the integrated learning environment. The scope of such a system is not the satisfaction of the learner but the effectiveness of the learning process in terms of perceived value.

Figure two, defines the learning process Analysis as a combination of four relevant learning tasks: Find relevant objects, set interconnections, integrate meaning, provide new meaning. The Author of the e-learning system in order to use this learning process on a specific course that develops has to put effort in various requirements. For example he must provide to the knowledge base of such a system a number of "relevant" objects such as theories, real world case studies, abstracts, experiments etc, in order to make capable the student to find them. Of course this operation is not very easy because its object would have to be accompanied from various metadata. The conclusion is that each learning task needs further analysis in order to set the requirements for its technological support in terms of databases, metadata, procedures that manipulate them. The underlying issue is an object-oriented approach: The e-learning environment derivers value to the students but this value in typical e-learning systems is hidden. The major reason is the inability to define and to deliver this value in terms coherent to students.

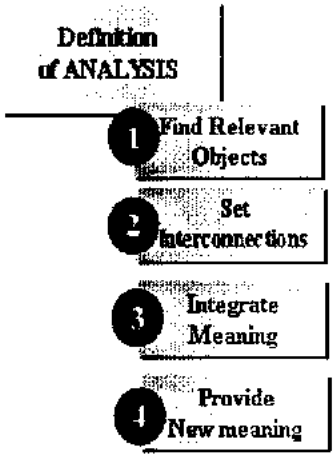


Figure 2. The definition of learning process Analysis

A second variable for the establishment of dynamic learning environments would be the development of learning products with a different mix of value components in terms of knowledge, attributes etc. For example if we were interesting for the establishment of an e-learning system capable to provide content for Internet basic skills we would have to formulate different learning products. An advanced system would be responsible for the reconstruction of the learning products in format that could support the different learning processes.

Additionally the reusability of learning products is very important. Most of the learning environments that are dominant in the e-learning market today do not support a re-usability mechanism based on relevant attributes of the learning content. For example if we use WebCT or Blackboard as our delivering platforms for e-learning, our decision to reconstruct our course will be a pain-full procedure. In other words the content management in our expert e-learning system has to be based on an advanced content management mechanism. The author of such a system would have to characterize its material (html pages, pictures, texts, docs, images, image maps, screenshots, demos, simulations etc) according to specific characteristics (target audience, suitability for specific learning processes, metadata, keywords) in order to build the database of the educational products. A number of these elements constitute an educational product. The reader-student of the e-learning session will be able to discover the learning scenarios and its contents through specific learning processes. This approach is very important as it tries to justify the parathesis of learning content in an organized way. But the success still remains on the willingness of the teacher to prepare the learning content that will be suitable for the support of all the learning processes. Because if an author uses on his e-learning session a repeatable sequence of learning products that are suitable for only one learning process then the whole system will be malfunctioning.

From the author perspective, the availability of different learning processes on a first step would allow the building of learning scenarios. Each learning scenario could be a sequential or parallel continuum of learning processes that have to be customized in order to have value for the student. In general an intelligent e-learning system would have the functionality to drag and drop learning processes on an educational space layout. After the completion of such a procedure the author will have the overall learning scenario for a session or a course. It has to be clear that the author of such a system will face the learning processes as black boxes at the beginning, without much information about their overall learning tasks.

The learning scenarios builder can be more intelligent if the information technology capabilities create an expert system on which an author will be able to find from a scenarios data base the appropriate learning scenario for its course or for its problem. Variables in this case would be the context of the problem, the type of the audience, the characteristics of the subject etc.

Logical presentation of the e-learning paradigm

The four dimensions of e-learning micro cell, personal value, knowledge web, human community, learning process, provide a context for analysis. The scope is not to exhaust their practical meaning but to understand the complexity of the related issues and the efforts that have to be paid in order to define the technological implications of the desirable learning environment.

The dimension of personal value for the e-school architecture is of critical importance. If we develop a customized learning environment with concern not only to class management characteristics then we could be able to prove the significance of personal value in school settings. The need to reveal the personal value could imply characteristics such as profiling capabilities needs recognition, customization of knowledge, learning styles classifications, personal webs and many others that have to be specified.

In correspondence the dimension of the knowledge web recognizes the prerequisite to create an advanced knowledge management mechanism since the knowledge component in schools reality is more than important. The establishment of customized knowledge situations, the capacity of e-school to support and deliver knowledge in various formats, the development of search facilities that ensure knowledge discovery are only a few of the technological implications of the knowledge web dimension.

The realization of the human community within the e-school requires the support of team building through distributed work, the establishment of complementary tasks, the promotion of dialogue and relations, the evolvement of motivational mechanisms and the setting of personal development.

Finally the endorsement of the learning process of e-school needs the detailed analysis of concepts such as learning scenarios, learning styles, learning situations, learning goals and their integration with technological capabilities.

To sum up, the e-school architecture has to build its capacity on Knowledge management mechanisms such as knowledge creation, knowledge codification, knowledge categorisation in concrete ways of learning templates in various fields, case studies templates specifically codified for the needs of primary and secondary education and communication mechanisms, including teleconference.

The e-school is not limited to a closed internal circuit. Its basic objective must be to be open to the society. In such a scope of participation the EU educational policy, the opinions of educational associations as well as the experts experience and moreover the social culture are not regarded as external push factors. They develop a wider web of access and constitute stakeholders with specific interest for the being of e-school. The government bodies, the teachers, the students, various scientific forums and associations, experts in various fields, the academic community have to pay a significant role for the e-school efficiency. All the above-mentioned stakeholders have to be connected with e-School architecture on a way that maximizes the potential usefulness of the whole system. Their connections to the e-school have to be analyzed in order to specify the technological requirements for the realization of the effort.

On e-School the object is to enhance the contributions from the various stakeholders and to facilitate their relations with specific procedures. The role of each stakeholder has to be analyzed and to organize very carefully. A critical question concerning this analysis is whether e-School is going to be configured on a national base. Our intention through the analytical description of e-school is to establish an integrated system, on which there will be different levels of functionality and access permissions.

The knowledge diffusion within e-school links the two distinct components of e-school. Through the establishment of direct relations the school community proves its interest for the empowerment of the performance. Students provide personal data, use profiling techniques, publish info on personal webs, navigate through learning scenarios, discover knowledge, enroll in courses and in seminars, ask experts, prepare team works, and prove their many interests through special events such as an on-line newspaper. Teachers prepare learning content, use different media in order to test their educational value, organize virtual workshops, use self-training and implement evaluation of the learning process.

The government in general provides the context for the host of e-school on an (inter) national basis. The technological subsystems of e-school are developed in order to support a wider in terms of place and time school community. They support the operation of e-school in financial aspects and provide links for the e-school to government organizations etc.

Experts in various fields, e.g. academics, professors, associations, non-profit institutes, provide their expertise in order to expand the functionalities of e-school through forum discussions or e-seminars that organized for various target groups.

With no doubt the reinforcement of e-school micro-cell through this web of stakeholders requires a technological infrastructure and the development of innovative strategies for their effective implementation. The two levels of e-school conceptual approach the micro-cell and the macro-dimension constitute a knowledge management mechanism that tries to capitalize the tacit and the explicit knowledge of all the participating stakeholders.

The conclusion of the above stated conceptual ideas is the necessity to create an e-learning system on which the concentration will be on the establishment of value delivering mechanism to the students. The two-fold functionality of such a system will support authors and students not from a class management perspective but rather from a knowledge management perspective. The web of processes available for the students will address the need to maximize the value of an e-learning system for the students. In synopsis the major logical components of such a system include:

- A number of well defined learning processes. Every learning process has a number of learning tasks, as well as every learning process requires specific learning products for its effective implementation.
- Learning scenarios that manipulate learning processes on a manner that integrates meaning. These scenarios may be available through a template base or could be created dynamically and stored according to author's preferences.
- Learning products that incorporate value components such as needs, knowledge, motivational elements, problem solving capabilities, team synergy characteristics etc.
- Learning templates that facilitate the organization of educational products within specific learning processes.

Architecture of the e-learning system

The development of an e-learning system that will facilitate the realization of the concepts that we discuss earlier of course is not a common project. The need for extensive research in many dimension of the whole problem is required. But in this section we will try to state a number of research findings that seem to have an essential role in the architecture of the system.

E-School, our e-learning paradigm for national development, proves that information society is a critical success factor for the effectiveness of the school of tomorrow. From a technological perspective e-school uses leading edge technologies (web based training, teleconferencing, web databases, Internet programming, multimedia authoring tools) to set a complete Internet solution. The diversification of the potential components of e-School, and their flexibility to create customized learning procedures that deliver value to its users.

Furthermore the specific development characteristics of E-School do not intend to substitute the traditional school with a complete virtual learning environment. The scope is to analyze the requirements of this school and from social perspective as well as from evolutionary psychology and to justify the use of information technology. To be more concrete e-school:

- Expands the learning capabilities of traditional school
- Enables excluded people to participate in learning
- Allows the implementation of flexible knowledge construction

- Secures the openness of the school of tomorrow to the society
- Establishes synchronous and asynchronous modes of communication for students, teachers, experts, government establishments, universities and other bodies that influence the school field.

The overall proposition of e-School is the total Internet solution that combines three levels of analysis:

- Learning Intranet,
- Learning Extranet and
- Learning Internet.

The first level is the internal web of capabilities that e-school has to utilise in order to support all of its users but especially those that are dominant in the traditional school e.g. student, teachers. The flexible IS technology is for e-School a critical issue. For this reason on this level too much attention is paid on customisation techniques that secure that e-School content is customised and reformed in templates due to user needs.

The second level expands the communication capabilities of the e-School. It brings together experts, associations and universities with the school community. Using technologies as teleconferencing the e-School gains flexibility and communication capabilities that can not be realized in the traditional school. The learning Extranet is mainly responsible for the adoption of distance seminars, teachers training and virtual web based seminars.

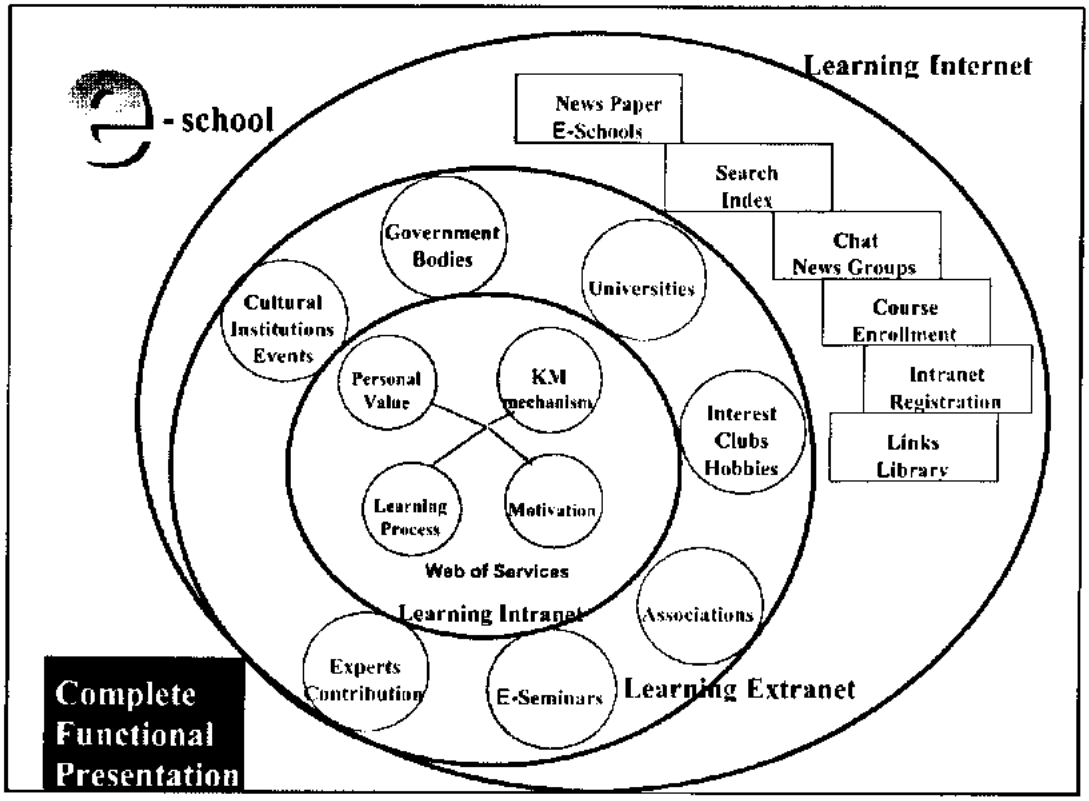
Finally on the third level of analysis the e-School is opened wider to the society. The resources on this level are available to everybody that has access on the Internet and all the facilities are facilitated through an integrated learning "portal". Technological capabilities such search engines, indexing, chat, newsgroups, encyclopaedias are created with a problem solving orientation and team skills development.

The school of tomorrow must be open, flexible, capable, dynamic, and in this context the information technology provides personal value. Knowledge Management mechanisms, learning processes, dynamic linking of educational scenes, templates building, role playing in a systematic way.

For the fulfilment of the pursuing objectives, the e-school needs firstly to create by the support of informational technology an internal core of knowledge management mechanism in a way that secures the personal value for its users, and secondly a wider web that can be accessed by each involved. In other words, the e-school consists of two distinct technological structures:

In general e-school derives its flexibility from three different but interconnected facilities:

- The **Learning Intranet**, which is a sophisticated system of KM mechanism, student profiling, motivation subsystem and learning processes management, the access of which is limited to students and teachers at the operational phase. Access is given through a system of registration and levels of security.
- The **Learning Extranet** with special technologies as teleconferencing and web based training through which the e-school opens to the society bodies. Via this subsystem the core knowledge of e-school can be accessed and multiplied with contributions from bodies that have specific interests in the schools matters.
- The **Learning Internet**, a wider subsystem that can be accessed potentially by citizens interested in the learning process and content of e-schools. Functionalities of this level include a sophisticated search index with categorized links for scientific fields and support material. The creation of such an index will be based on a specific evaluation methodology of the scientific value of web sites that refer to links. Additionally there is special interest for the establishment of asynchronous mechanisms of communication through chat rooms and newsgroups. Moreover the web of schools that have access to e-school technological infrastructure can publish information on a virtual newspaper. Through this level access is allowed to the learning Intranet and Learning Extranet.



Conclusions

The e-learning paradigm that presented in this paper will formulate a EUMEDIS proposal for the forthcoming submissions of proposals in January 2001. In the current stage our research effort is concentrated on the specification of the technological requirements. All learning processes involved are analyzed and very soon there will be a concrete description and in terms of technological requirements. Additionally ORACLE 8I is tested as a development platform for the components of the internal circuit of e-School in combination with platforms such as Blackboard and WebCT. We are looking forward to have comments on our research and proposals for collaboration in new projects concerning e-learning and knowledge management.

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USER ASSESSMENT AND LEARNER TRACKING AGENT LAYER IN AN INTERNET TRAINING TOOL

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Abstract

During the last decade, distance learning has been considered at a lower rank to traditional education. Today it is required as an efficient alternative when apply to Information Technologies. We have been working on an integrated distance learning system based on Internet (EITIN). We use the web openness, interactivity and multimedia capability to build an interactive courseware editor and a multi-model exercise generator for self-evaluation and validation in distance training. The purpose of this paper is to present an ongoing work where we use agents concepts on top of the previous model to bring out a multi-layer training tool that assess and track user's activities on the system.

1. Introduction

A rapid observation of the world tendency in education show that distance learning has benefited a lot from the ongoing progress in the new technology area [1]. Nevertheless, using computer as pedagogical tool in a distance learning context poses problems unknown in traditional experiences, those related to the assessment of the user's movement and the learner tracking.

In our previous works, we have achieved an Integrated Internet Teleteaching Environment [11]. This tool design with object oriented methods did not integrate the capability to rate usage discrepancies of the unlike system's users. Furthermore several laboratory activities have experiment the range of cognitive, reactive and adaptative agents in laying out the trail of users. The question that we raise is how to build an agent layer on top of object system to qualify users' behaviour by detecting keying disparity so as to better support them when they use the environment.

Our answer articulates on three parts. After a brief review of agent concept complexity, we present some multi-agents systems that are working using Internet services. We study the layered architecture agent architecture and apply it to our previous work. Finally we propose a frame of our model and we describe the sub-module functions.

2. Multi-Agent Systems as educational tools

Man is characterised by his intelligence, his ability to communicate and to cooperate. Observation of his behaviours and many of his parallel activities are at the origin of many searches on multi-agents systems as organisation model [2]. Nowadays researchers are trying to create intelligent agents in the form of software or of robot, considered as autonomous entities equipped with an artificial life. They co-operative when they share common objectives as in an ants colony or they are egoistic when they deal only with their interests as in market economy. Many activities sectors are involved in satisfying simulations: electronic trade, industries, search engines. One of the fields particularly interesting is the one of education where various multi-agents approaches can bring unexpected solutions.

2.1 From Agent to Educational Multi-Agent Systems

Using agents is an up to date concept but that notion remains somewhat difficult to define. According to Nwana this is due to different opinion between logicians and researchers of the field of the artificial intelligence, but also because of many synonyms which are created [3]. Ferber presents two orientations. The first approach which he describes as weak is based on objects concepts and defines the agent as an object with scripts permitting him to be driven from a site to another. The second approach indicated as being strong estimates that an agent is a data-processing entity that should verify at least seven conditions [4].

This complexity led researchers to define agents according to their specificity. But here also, the fight of the names is not closed. With all possible associations of basic characteristics that are accepted one with the agents, let recognise that we are not far from a combinatory explosion. In a classification that is currently accepted, three parameters are usually used: mobility, agency and intelligence leading to at least seven main categories of agent: interface agent, autonomous agent, collaborative agent, mobile agent, information or Internet agent, reactive agent and hybrid one which has one or more of the basic characteristics.

The rapid emergence of agent technologies has given new directions to Intelligent Tutoring Systems (ITS). Indeed, the conceptual representations of different parts of an ITS has mature to interface agents, reactive agents, pedagogical agents [5]. These significant properties in the educational plan remain limited when modelling human behaviour at the time of training. This problem has been resolved by the addition of adaptivity, instructivity and cognitivity to basic properties [6].

2.2 Typology of MAS using Internet

Internet availability has boosted the implementation of agent using it as a training tool. Many researchers are setting systems to produce and manage educational material [7] or to realise methods for information acquisition keeping users out of overload. These agents role is generally to collect data resulting from several servers [8]. They also have other roles such as mail management, news filtering, work selection, lower cost search and remote lesson setting. We give below four types of multi-agents training systems for which we will recall their agent layered architecture.

1. Lanca.

Until now solutions suggested by Intelligent Tutoring Systems did not cover the large variety of learners' profiles. To be able to anticipate for each training case Lanca[1] [9] uses many strategies. It benefits from the assets of the intelligent tutoring systems, the new techniques of intelligent agents to offer the learner an adapted and specific assistance by the detection of its difficulties.

- *Pedagogical agent* uses the learner model, the process analyser and a lot of strategies for learning supervision. It detect the learner weaknesses for which his interactions with the system are tracked,
- *dialogue agent* manages explanations which are then placed at the learner disposal when those given by the pedagogical agent are not sufficient,
- *negotiating agent* which is charged of selling all the explanation formulated by its learner,
- *Moderator agent* which supervise and ensure that the whole system function well.

These agents may function locally or through the Internet network with three layers [10]: a reactive level for communications, a strategic level for planification and a cognitive level for learning and new facts discovery [8].

2. Cmos

Cmos[2] is a real-time simulator intended for individual and collective training. This environment is based on the multi-agents intelligent tutoring system ASITS (Actor System for ITS).

Gouardères develops the new concept to elaborate more appropriate tools to human operators. The aim is to enhance the fiability mechanism when procedures are not well applied during aeronautic simulation training. From an analysis of three different simulation trainings, the author releases the human factor limitation and the lack of progressive evaluation oh the learner competencies. He proposes a "complete simulation" concept, a solution that integrates to three systems paradigm: liability, distribution and quality.

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[1] Learning Architecture based on Networked Cognitive Agents implemented within the Convivial and Efficient TeleLearning (CELT) project [10]

[2] Cockpit Maintenance Operation Simulator supported by Airbus Training

This tool implements reactive and cognitive agents to follow the learner performances, to detect its cognitive variations (inherent negative effects) when he interacts with the system. In addition, they identify the simulator imperfection [11]. The proposed prototype is done over three layers supporting tracking and interactivity. They are the real-time kernel, task knowledge basis and the task analyser.

3. Larflast

The aim of Larflast[3] is the realisation and experimentation of tools for foreign language scientific terminology [7]. The aim of the project is to produce educational material by extracting useful knowledge from the web into interactive documents. It will then be used to generate local Web pages with their associated interactive processes for learning. Cerri calls this serendipitous knowledge acquisition. The Scientific Terminology Learning Environment (StyLE) architecture relies on communications between human and artificial agents through two communications language build on the basis of the STROBE model. They are three function phases: the serendipitous information acquisition from the Web, the transformation of information to knowledge and the use of the knowledge.

4. Logobots

In Logobots [8] a multi-agent system based on Internet, the aim is more specific the training American Armed Forces soldiers geographically dispersed. The Principle is the use of intelligent agents for the automation of the bookmarks. A teacher agent collects from Internet the training materials that are classify by field of specialisation. They are stored on an Intranet server from which they are accessible. Logobots is built around directed agent tasks, which use two typologies: interface agent and information agent. Each learner has a personalised interface agent charged to increase its knowledge base with new information.

5. Steve and Adele

Steve (Soar Expert Training for Virtual Environments) and Adele (Agent for Learning Distance - Light Edition) are pedagogical agents with the ability to support human learning in an interactive learning environment. They are autonomous and interact with students to facilitate their learning. The environment includes both students and the learning environment in which the agents are situated [12]. Johnson teaching agents are built to be lifelike animated. Adele for example relies on four main components: the pedagogical agent, the simulation, the client-server and the server store.

Although well drawn to realise what they have been created for we should recognise that the complexity of such a system raises different types of problems. Beside the communication standards between agents, there is the control related to the users' activities that can lead to three types of cognitive variations: (1) the contextual variation, (2) the rate of renunciation (dropping gap), (3) the tunnel effect. Most of the system we have studied do not integrate this important aspect. On the Eitin[4] we building an agent layer Assess users' activities. In the following section we present what have been done and what we are doing.

3. Eitin: A Training Tool

The expansion of telecommunications technologies and new data processing techniques has increase tenfold teaching models with many tools using the Web or other Internet services. Despite numerous performances, these systems present limit. Pedagogical auxiliary functions are operated separately and the tendency to the training personalization very often ignored..

This observation led us to the design of a system using artificial intelligence techniques to generate and manage tutorials as support to distance training. The main objective especially for developing countries was to lighten teacher's duty with a device, which supply him in a school area where he does not permanently stay. Therefore, he can build his lessons and exercises and submit then to learners who could take their lessons easily with no fear to be lost through many links as they do when they use the Web [13].

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[3] Cockpit Maintenance Operation Simulator supported by Airbus Training

[4] Environnement Intégré de Télé-Enseignement basé sur Internet

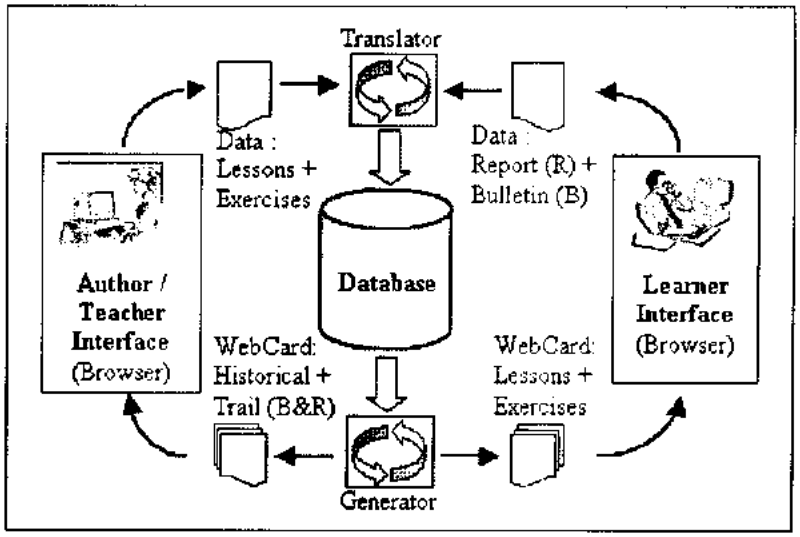

Figure 1. Operating cycle

Figure 1 display the operating cycle where the database holds knowledge and working information, the translator and the generator ascertain respectively documents reception of data and sending of WebCard.

3.1 Knowledge construction

Author who is not absolutely a teacher assembles modules composed of knowledge units via a Web interface, the interactive module editor. He creates corresponding exercise through the editor exercise (EDE) these data are recorded in the database.

Teacher who can be an author uses one or several modules published by the author to compose a functional pedagogical unit corresponding to a precise goal through mounting table (TAM). He houses them in the order of the learning such that to be able to control the learner evolution.

The acquisition evaluation system (EVA) is made up of a controller (CTRL) who ensures the supervision of three editors: the exercise editor (EDE), the survey editor (ESO) and the supervised duty editor (EDS) which provide various functions.

The EDE helps to create and manage the tests for self-evaluation and exercises which are recorded in the exercise bank (BEX). The EDS allows to produce supervised duties (Ds). They are composed of exercises drawn randomly from the bank. The ESO ensures the creation and the management of the selective tests which are specific questions to a topic and whose analysis makes it possible the homogeneous groupings of the target public and selection of what they need for their training.

3.2 Knowledge acquisition

Learner acquires new knowledge in a field of his choice through the learning system (SYA) according to pedagogical steps settle by the teacher. When a learner connects himself for a learning session, particular files (course, exercise, messages, etc.) with specific format (WebCard) are generated while he is moving. These transactions with the system produce statistical information (reports and bulletins) that are returned to the server to be kept as the trail.
A teaching starts and ends with a survey. The first one helps to determine current knowledge of the trainees in the training area considered. The data resulting from the selective test determine how they should be grouped with the adapted modules. The last one measures the gaps between the improvement, the content and the usage of the system.

The training is a sequential process where units of knowledge (UC) are interrupted with tests allowing learner to appreciate its comprehension of the subject. At the end of the module two cases can arise: (1) if teaching is personalised, the multimodel generator manufactures a private supervised duty according to the learner profile. The orientation towards the next module depends on the grade obtained. (2) In case of

a homogeneous group, the teacher generates a global duty for the group. In all the cases, the learner progression produced a report for the tests and a bulletin for Dsi/Ds.

3.3 Tracking and assessing users

All users of the system have an activity record built from their interaction with the system. A synthesis of these data makes it possible to know what is done but we can also use it to help both the learner and the teacher. We are now trying to build an agent layer (figure 2) on top of what has been done to track, assess and assist all those interacting with the system.

We suggest to add to the system a layer of agents for the supervision and the tracking of the users. The aim is to build a multi-agent system for teleteaching with a more reliable presential and social context. Our approach is based on transactions detection that allows the specification of data and flow of control at every level of abstraction and displays the virtual class activities. Transactions made by the users are introduced from their interface (author, teacher, and learner). They concern manufacture and publication of modules or exercises, structuralisation and assembly of pedagogical unit, prescription of a lesson, learning or evaluation. Figure 2 shows the system architecture that implements three types of agents: the tracker, the controller and the mediator.

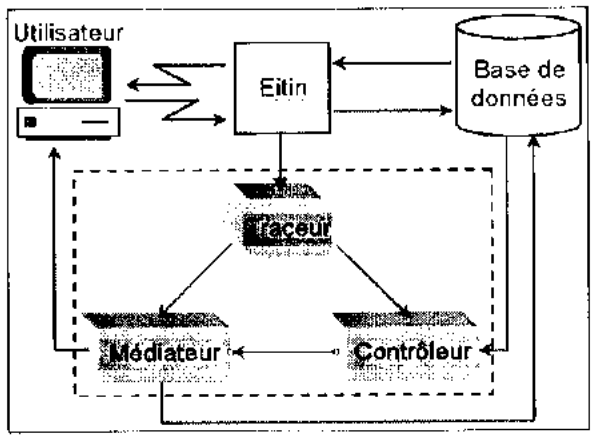

Figure 2. The system architecture

1. The tracker agent is autonomous with cognitive ability and able to take decision from state approach parameters such as use of button, transitions to modules and practice behaviour when taking an exercise or a test. The tracker agent is the informer of the system. It captures all the transactions of the users in the database and builds their track, the set of the sequences of operations realise on the basic modules of the system. It informs simultaneously the controller agent and the mediator agent.
2. The controller agent compares current activity with the data of normal use. If he finds a gap it informs the mediator agent. The controller agent also assures learner-teacher dialogue and learner-learner cooperation. A communication is established directly by clicking the icon of the user which one seeks. In case of presence one can communicate in a semi-synchronous way. In case of absence the message is store until its next connection, but an agent is call to help and give any available information. Presence is always assured.
3. The mediator agent is an intermediary of communication. It builds the virtual class according to appropriate sights of every user. It displays to them at the rate of their transactions an update of the corresponding entity from the database. It sends to the user the help that he needs to evolve correctly, when the controller informs it of any dysfunction. Besides, it makes the historic of use of each user.

5. Conclusion

Several and significant work have been done within agent and ITS research area. Systems are performing more complex tasks in which different elements can have human learning ability.

This study approach intend to use some of the recent findings to ameliorate a system that already exist and to tackle the problem that can arise when many agents built at different time have to collaborate. In the current case the presence of a general information database is an advantage. We know the data format therefore we can set up a tracker with particular process.

To the dawn of the third millennium, at the hour of globalisation and the digital civilization, it is especially urgent to be up to date with the technological developments changing in all domains, and particularly in the education. Tele-teaching appears more and more as an industrial process, a factor that gather people all over the world. Indeed, it changes the fundamental concepts of " Space-times ".

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IMPLEMENTATION OF SCIENTIFIC METHODOLOGY AND MODELLING TOOLS IN AN OPEN CLASSROOM (AGES 10-17)

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Abstract

Learning is the outcome of formulating questions, reacting, investigating and sharing. The advantages of familiarizing students with scientific methodology in comparison to simply transmitting knowledge are obvious. On the other hand, scientific methodology cannot be applied in the narrow limits of a conventional classroom since the last does not give students the possibility of accessing contextual subjects of everyday phenomena with international interest (e.g. environmental studies) neither to feel like young scientists who publish their studies, talk to international conferences. Open classroom can provide the learning environment that can embrace exploratory activities and modeling theory. Two projects have been developed each for different student ages, for the application of scientific methodology and modeling tools in an open classroom. Special care has also been taken for a smooth introduction of students at these representational tools that are essential for competent modeling and problem solving together with easy instructions for every step of the procedure. The results of the implementation of such an educational method and platform show that on the cognitive level students working in the project significantly gained more insight into measurement procedures and the scientific way of thinking.

1. Introduction

Contemporary science teaching methods treat teachers as facilitators while students construct their own understanding. Students are no more treated as a vessel to fill but as a candle to fire.

Students are actively engaged in understanding the physical world by constructing and using scientific models to describe, explain, predict, and control physical phenomena. The role of the human mind is crucial, since the conceptual scientific world consists of shared concepts for interpreting and representing the physical world [1]. The three-world model - the physical world, the mental world and the scientific world [2] - gives a penetrating description of the abstraction process which must take place in order to understand physics [1]. There are two major advantages by engaging students in modeling activities. First their classroom experience is aligned with the practice of working physicists and second by focusing on basic models the structure and coherence of scientific knowledge becomes more explicit and evident to students.

The main problem in learning science is to shift from a subjective perspective to an objective formulation of models independently of their origins. In order to spark this creative process in students, we need pedagogical instruments to engage them in active participation. Our proposal is to:

a. apply the scientific methodology in the classroom,
b. use diagrams as representation tools in modeling theory.

2. Scientific methodology in a traditional classroom?

The stages of scientific methodology are well known but rarely used in the classroom. Very often teachers use in the classroom methods that they couldn't tolerate in a science laboratory. Specifically, the stages are the following: a. triggering - statement of the problem, b. statement of the hypothesis, c. laboratory procedure, d. conclusions and e. feedback. Even if a teacher tries to follow this scheme at the science classroom, two of these stages would remain inactive: feedback and triggering.

As far as it concerns triggering, this stage looses much of its importance inside a traditional school classroom or school laboratory for three important reasons:

a. The experiments that usually take place in a school laboratory are very simple, in total opposition with the complexity of everyday phenomena. This fact gives students the wrong impression that science does not deal with everyday phenomena and additionally that everything in science as been studied and so science is an almost dying subject.
b. Even in the school laboratory a lot of students seem not to be interested in pure science as far as it seems isolated from their own interests. This is a crucial point, since modeling theory requires the maximum possible interest and participation by students (According to modeling theory, participation enhances learning).
c. According to the modeling theory of learning [3,4,5], the pupil constructs by himself its own mental model, its internal illustration of various phenomena, with an additional serious effect of the social environment [6,7]. The domination of this new theory of learning defines new facts about teaching even at the elementary level. The great significance of the social environment especially within a transnational community comes to a contradiction with the narrow limits of the classroom. The traditional classroom does not at all correspond to the transnational society we experience in real life.

Another important step of the scientific methodology is feedback, the need to expose the results of a study into international judgement. This necessity as well as its importance is obvious for the scientists that publish articles into scientific magazines and speak to international conferences, but it is not at all obvious for the students as far as they experience scientific practice in the narrow limits of a traditional classroom. Even if we motivate students to write surveys upon their studies finally they will loose all their interest since they hardly get any response from their fellow young scientists. Therefore it seems quite difficult (if not impossible) to experience the scientific methodology in a traditional classroom.

3. Scientific methodology in the open classroom

New technologies and O.D.L. have offered the possibility of an open classroom. Our point of view is that open classroom fulfill all the presuppositions for the correct application of the scientific methodology in the classroom. The open classroom can:
a. Provide a wide approach to school subjects, which are forbidden up to now by the curricular framework. There are interesting chapters in every subject that may have a direct relation to everyday life or to students' social interests (e.g. biochemistry, electromagnetic radiation, sound e.t.c.), that have been ignored due to lack of time in the curriculum.
b. Treat natural sciences and school subjects in general with a broader mind. Students understand that physics and chemistry are related to every other science that they are possibly more interested in. In this way the number of students that feel alienated from these subjects is strongly reduced. Another subject, Technology, is also interesting, either as a helping tool or by critically examining its results.
c. Provide students with the possibility to become aware of the different aspects of scientific methodology, through their activities, from the measurements to the very important task of writing a scientific study. The last is the milestone of the scientific research and the confirmation of its value, as a sharing of scientific experience with the rest of the scientific community.

Additionally, a certain number of pedagogical benefits are provided for the classmates of an open classroom:
a. The possibility of a wider search for information, a search beyond the limits of the school, as well as the utilization of this information.
b. The possibility to communicate and cooperate, especially when they have to overcome obstacles related to distance (video conferencing, chatting, electronic mail e.t.c.).
c. The opportunity to analyze and compose a problem so as to be able to be understood by a transnational group of students.
d. The opportunity to be exposed to the terms and the language used by researchers. As we mentioned before, a very important part of the scientific methodology is the written report - outcome of the whole research. Students are asked to clearly define variables, limitations, state assumptions for relationships of variables and represent them graphically. Thus they become familiar to scientific methodology.

Therefore open classroom meets all the presuppositions for the application of scientific methodology since it maximizes the students participation and interest and by offering the necessary feedback to their scientific research.

4. Diagrams as modelling tools

To introduce modeling tools in an open classroom apart from the scientific methodology, we need an environment that enhances student learning. This environment must fulfill some criteria:
i. it must be web based since it must be applied to virtual classrooms, ii. it must provide the students some modeling tools such as data input and analysis through graphical representations.

To promote qualitative reasoning we use diagrams as representational tools. We have selected the plots since such tools are essential for competent modeling and problem solving [8]. There are two ways to approach diagrams and both have advantages and disadvantages:
i. Students use already plotted diagrams. In this way they can easily discuss certain issues concerning variable correlation. Two are the main disadvantages. First, students do not really learn how to plot a diagram by simply using it; therefore they do not get to know several technical as well as scientific details (such as scaling, accuracy, fitting etc.), essential elements of plotting. Additionally, since they chose from a given list, they are not free to draw whatever diagram they would like, using any variable, at any time interval etc. This way they are not free to express their own mental model of the phenomenon. ii. In the second approach, students actually draw by themselves the diagrams. In this way they can freely define the axis - variables, the scale etc., and so express their own model and understand all scientific details that lie beneath the technical difficulties. The main problem of this approach is that its implementation takes a lot of time, making it difficult to be used on a wide area of subjects in the science class, although it is expected to be much more effective than the first one.

Our proposal is an Exploratory Learning Environment (E.L.E) that we have constructed, which provides students total independence in choosing any combination of variables, the scale and additionally any combination of data onto comparative charts. This way it is actually the students who draw the diagram, not the computer, since they set all the parameters. Additionally they draw it quickly, as they do not use any pen; the ELE executes their instructions. This, by any means, does not imply that students must not draw diagrams by hand. Simply it is the only way to make them use diagrams for every phenomenon they study without loosing a lot of time during the lesson or the science laboratory.

The benefits of using this diagram-oriented ELE have two dimensions: the first concerns the diagrams themselves and the second the modeling theory.

(a) Concerning the diagrams, students can see how a plot is altered when scale chances. They learn how to choose the diagram scale in order to study a detailed part of a diagram or to have a more general view. They learn how to take into account the accuracy of the data. From the physical point of view, they learn to use diagrams in order to find possible correlation between several variables and to test their model of the phenomenon they study.
(b) Concerning the modeling theory, there are two kinds of representation for the model: an objective representation (by diagrams for example) and a mental one in the brain of someone who understands it [9]. Using certain teaching strategies, we stimulate students to use these plots to articulate their own models, to make predictions grounded on them and to make explicit comparisons between their own diagrams and the accepted scientific models [10].

5. Implementation

To apply our proposal in situ we have developed two projects for the implementation of scientific methodology and modeling tools in an open classroom. The first one is called e-Hermes (www.ellinogermaniki.gr/e-Hermes) which is addressed to pupils aged 14 to 17 years and the second one is called YouRA - Young Researchers in Action (www.ellinogermaniki.gr/ep/YouRA) which is addressed to pupils aged 11 to 13. Both projects have developed two different tasks in parallel:
a. In-service teachers and university students (future teachers) training, based upon an in situ application of an O.D.L. project in school. Teachers of the participating schools in co-operation with students of the participating universities obtain the theoretical background for the use of contemporary information and

communication technology in transnational projects as well as experience in O.D.L. application.
b. Pupils' familiarization with scientific methodology [fig. 1,2].

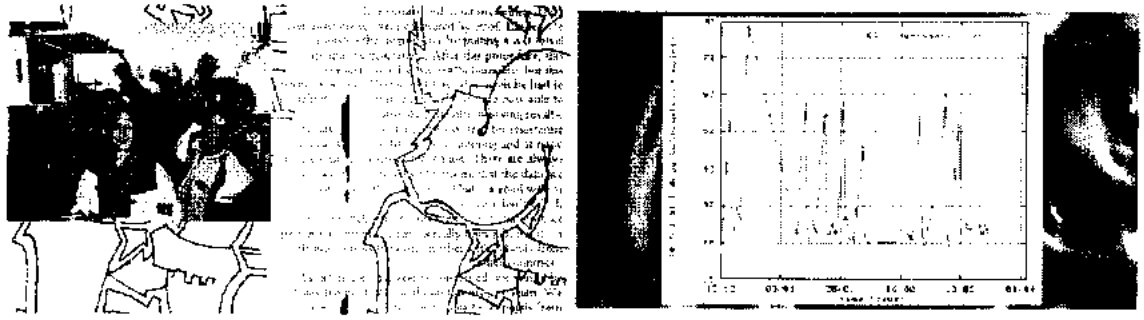

Fig. 1,2: "Students become aware of the different aspects of scientific methodology, through their activities"

At the YouRA project, the Learning Environment must fulfill some extra presuppositions since it addresses to very young pupils: Development and application of a methodology that it will help to overcome the obstacles that appear when using O.D.L. at young pupils. These obstacles are in fact communication problems, which are connected to some linguistic problems as well as to the familiarization with the information and communication technologies. An additional presupposition is the smooth introduction of diagrammatical representation, since these young pupils are not familiar with this kind of representations. The Exploratory Learning Environment has been designed and constructed based upon the possibility of i) non verbal communication, ii) pupils' familiarization with information and communication technologies and iii)smooth introduction of graphical representations [fig. 3,4,5,6].

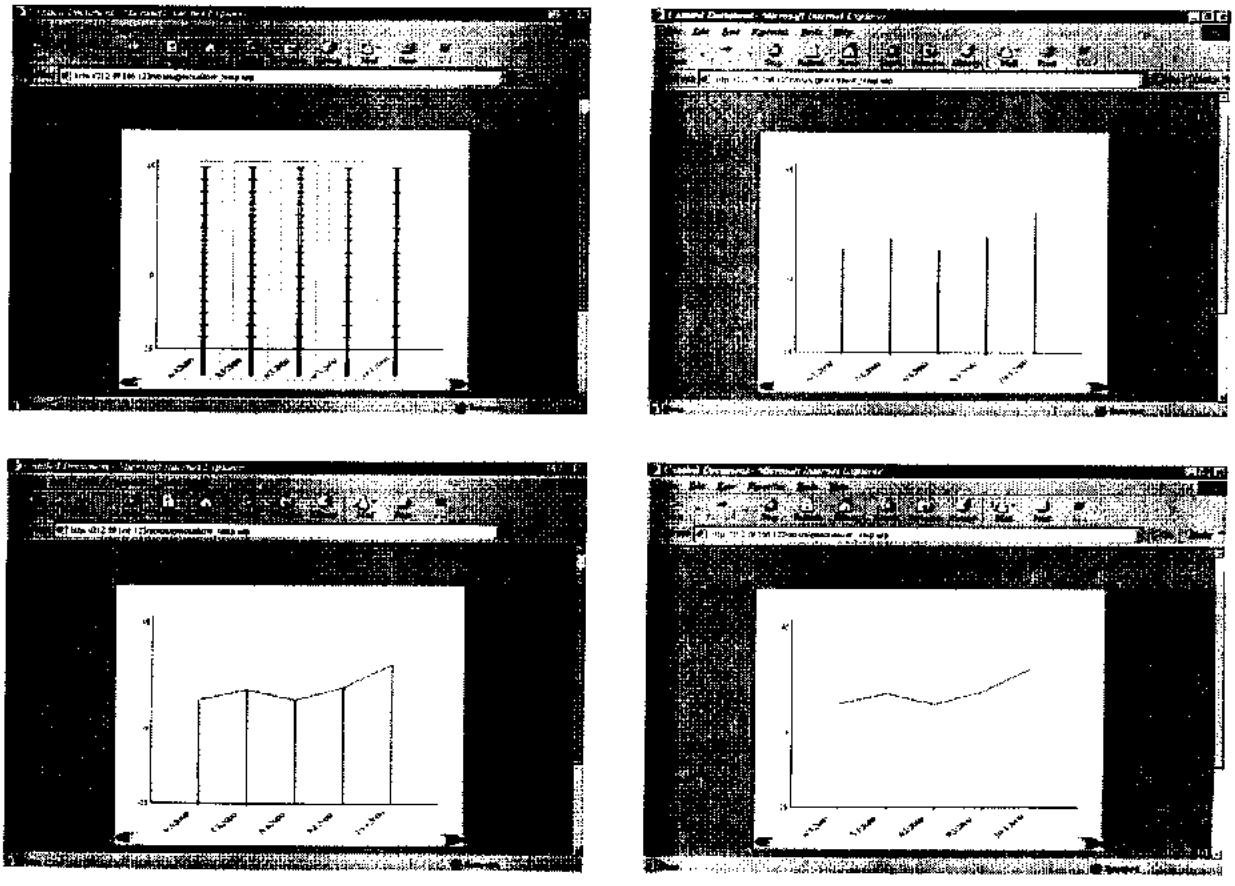

Fig. 3,4,5,6: "Smooth introduction of graphical representations"

The projects had been implemented mainly by three University Departments, Pedagogical Department of University of Athens (Greece), the Institute of Science Teaching and the Institute of Pedagogical Psychology of the University of Frankfurt (Germany). Additionally, three schools from different European countries, Ellinogermaniki Agogi (Pallini, Greece), Freiherr vom Stein Schule (Frankfurt, Germany) and BG und BRG Schwechat (Vienna, Austria) participate in the project. During the e-Hermes run ten additional school had been added to the working network. The YouRA project is now at the run phase.

6. Evaluation

The projects' Exploratory Activities are organized into stages - modeling cycles based upon the scientific methodology. These, six stages, are the following:
(a) collaboration in planning and conducting experiments, (b) construction of simple measuring devices, (c) data acquisition and data entry to the electronic environment, (d) provision of diagrammatic representations [7], (e) evaluation of model through comparison with empirical data, (f) discussion and report publication in a bimonthly student magazine as well as in the Internet.

The results of this implementation were very encouraging. When modeling cycle is built into instruction, pupils learn how to coordinate the complex cognitive processes of modeling to achieve definite goals. More specifically three major results were achieved, apart from the obvious familiarization with I.C.T.s.
a. First, pupils who had attended this exploratory activity became very familiar with diagrammatic representations, which they easily used in the science lesson, the science laboratories even in Mathematics. To test their attitude, students were asked to fill questionnaires. After analyzing their answers (using two groups, experimental and control group, and using two tests, pre-test and after-test with respect to the project) it came out that the project pupils could more easily read, interpret and analyze plots and identify quantities that correlate with each other.
b. Second, these pupils had started using diagrams as a tool for problem solving. This is very important because usually pupils solve some problems plugging numbers into equations and chugging a little arithmetic [7]. Using the diagrams they seemed to understand that they have to locate the model behind the phenomenon and not simple get to a number.
c. Third, on the cognitive level students working in the project significantly gained more insight into measurements procedures, starting from simple aspects such as how to reduce reading errors at analog instruments or how often to measure in order to ensure accuracy, to more complexes such as elimination of systematical errors. Students also showed an increased ability to read, interpretate and analyze plots, identify quantities that correlate with each other, approach elements of error theory and understand scales, averages, etc.

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INTERFACE: A METHODOLOGY FOR ASSESSING QUALITY OF EDUCATIONAL MULTIMEDIA PRODUCTS DEVELOPED IN THE FRAME OF A LEONARDO DA VINCI PILOT PROJECT

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Introduction

Underway to information society application of new computer based educational technologies - including first of all appropriate multimedia teaching materials - in the vocational training has become one of the top priorities in the European public education. Increasing efficiency and attractiveness in this field is a necessary condition for utilising human resources and therefore also for increasing competitiveness of European industry. Applying educational multimedia really successfully, however, requires valid and reliable measures of their quality by the help of which teachers can evaluate and compare different titles. The interface, that proved to be a powerful methodology for assessing quality of educational multimedia products, intends targeting just that very thing. The acronym stands for ***INTegrated Evaluation and Research Facilities for Assessing Computer-users Efficiency***. Based on more than a decade of experiences gained in the field of assessing usability of different commercial software products, the present advanced version of the interface has been developed in the frame of the Leonardo da Vinci pilot project titled "Developing and introducing multimedia teaching materials for vocational education"[1]. This paper summarises the basic underlying principles, main features and the available set of tools of this methodology, providing the reader also with illustrating examples of a case study.

Approaches to quality of multimedia products

Simultaneously with the increasing availability and possibilities of the newer advanced multimedia authoring tools and also with their increasing ease-of-use, we are witnessing an ever-broadening offer of growing number of multimedia titles. The quality of these products, however, does not keep pace with this increasing quantity. This is the reason that nowadays a definite demand has been articulated for well-established methods and measures of quality of these products. The quality of a single product quite often cannot be interpreted in itself, since its use is embedded into a complex teaching-learning environment and therefore focusing on the quality assurance and quality control of the whole process is a reasonable approach. On the other side, we argue that there is also a need for scientifically sound methods capable of identifying concrete weaknesses of particular multimedia products, because this way these weaknesses can be eliminated and – as a consequence - the overall quality can often be radically improved.

The generally used product-centred quality assessing methods fall into the following main broad categories:
(1) *Methods based on questionnaires and interviews concerning both users (students) and experts.* If evaluating scales are used these have to be carefully selected as they largely determine the answers. For example Barker and King (1993) in their study involving a total of 43 products identified such dimensions as *engagement, interactivity, tailorability, appropriateness of multimedia mix, mode and style of interaction,* etc. Of the above, in this study *engagement* seemed to be the most popular hallmarks of a quality product: over 50% of the exceptionally good products were rated highly in this category. The other listed characteristics also highly correlated with overall quality ratings. These questionnaire and interview methods can be useful for global evaluation involving a large number of respondents, but are definitely inadequate for identifying particular concrete dialogue or didactic flaws.

[1] The registration number of the project: NO. HU/97/1/43022/PI/I.1.1.A/FPI.

(2) *Analytic methods borrowed from software usability engineering as Cognitive Walkthrough or Heuristic Evaluation.* These expert methodologies are based on a large body of experiences and have detailed practical procedures, e. g. refer to Nielsen and Molich (1989), Nielsen (1994), Newman and Lamming (1996), Helander (1998).

(3) *Empirical methods that involve real users (students) in interaction with the system to be assessed.* A common feature of these methods is that the students are observed during their activity and some performance and/or strain parameters are also recorded. Newman and Lamming (1996) and Helander (1998) also provides basic information on this topic. An example for controlled empirical laboratory assessment of educational multimedia is given by Gobbato et al. (1996), who – together with carrying out a heuristic evaluation – also experimentally evaluated a distance course of mathematics in their specially equipped laboratory. These authors were able to identify a long list of interface-related and didactic flaws. Our INTERFACE method to be described in the following also belongs to this broad category.

The main features and functions of the INTERFACE

As we stated elsewhere - Izsó and Zijlstra (1999) - in any human-computer interaction efficiency refers to the ratio between 'benefits' and 'costs':

$$Efficiency = \frac{Benefits}{Costs}$$

If 'benefits' and human 'costs' are properly operationalised for interacting with educational multimedia products by using appropriate measures adequate both to the particular topic or task of interest and the students working on it, the '*Efficiency*' concept - as has been proved - can be a powerful indicator. The potential strength of this approach lies in the fact that it simultaneously takes into consideration both sides of the same coin.

A complex *methodology and a set of tools* have been developed to identify those parts of *student-multimedia* dialogues that require the most mental effort – the higher human 'costs' - from users. This method simultaneously investigates:
(*1*) *Performance of students* (based on speed, performance time, number of problems correctly solved, number of unnecessary steps or dead-ends, etc.),
(*2*) *Behaviour and observable actions* of users while performing. *This is* based on the following two pictorial information: (*a*) video recording of users' behaviour (acts, mimics, gestures etc.), and also (*b*) video recording of the current screen content. Recording students' behaviour has outstanding importance for the following reasons. First of all, by recording only performance measures we can not get any information about the difficulties students encountered. In this respect video-recording of the students' face and activity is an extremely rich source of psychological information as it directly reflects the mental state (e.g. boredom, routine activity in familiar environment, attention-demanding task, helplessness, getting lost, emotions as interest, excitement, frustration, anger, joy, etc.). Together with performance measures it makes possible identifying relatively weak points of the particular product. Playing back video-recordings tied to all the other recorded events (keystrokes, mouse clicks, experimenters' comments, psycho-physiological parameters' actual values, etc.) makes possible studying important pieces in more details simultaneously taking into account all important factors. Of course, it is possible to play back any events as often as it is necessary.
(*3*) *A special psycho-physiological parameter* - the power spectrum of HPV - which is closely associated with users' current psychic investments and, therefore applied as an objective measure of current mental effort. For more details in this respect please refer to Izsó and Wiethoff (1997), and Izsó and Láng (2000). In terms of the efficiency concept mentioned above point (1) refers to 'benefits', while some measures of the 'costs' can be derived from points (2) and (3).

The measuring and data collecting facilities are integrated into the INTERFACE assessing workstation the conceptual arrangement of which can be seen in Figure 1. The basic advantage and novelty of this methodology lies in its capability of recording continuous on-line data characterising the students' actual mental effort together with relevant events of interaction. Selecting a representative sample of students and compiling typical – or representative – set of standard tasks are essential methodological issues that

must be taken seriously. Some further information on the INTERFACE and statistical evidences for its validity can also be found in Izsó and Láng (2000) and Izsó and Hercegfi (2000).

In the following section a short case study is presented illustrating the use and outputs of the method.

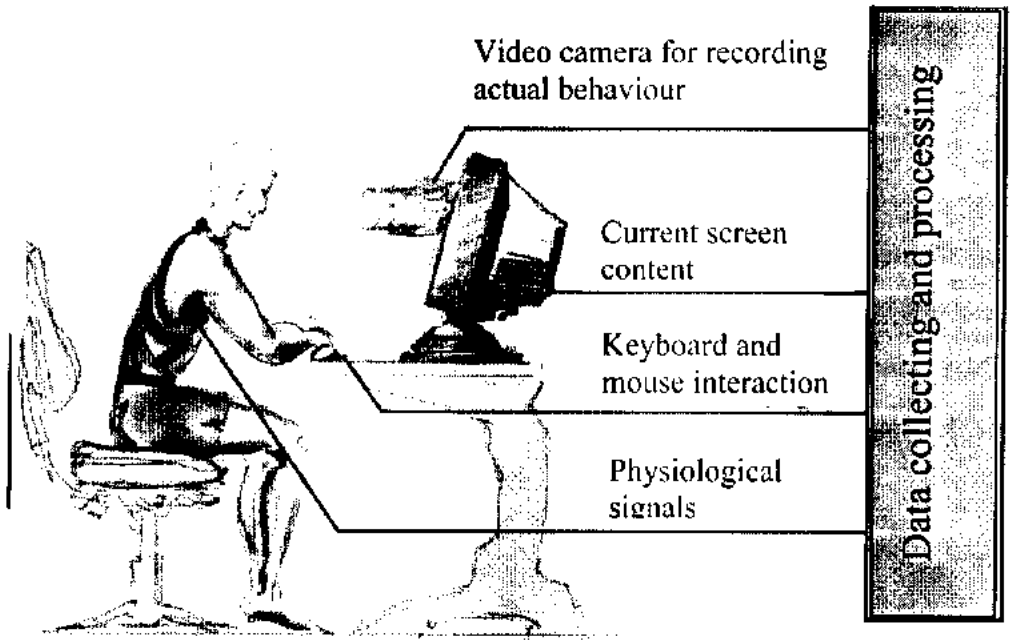

Figure 1.

The conceptual arrangement of the INTERFACE assessing workstation.

A case study: assessing the quality of a multimedia product by the INTERFACE

Our above mentioned Leonardo da Vinci project "Developing and introducing multimedia teaching materials for vocational education" covers the whole lifecycle of developing educational multimedia: needs analysis, early and detailed design, collecting source materials, producing and testing working prototypes, creating and evaluating advanced versions, class-room introduction and impact study, and follow-up study. The main goal is providing attractive, up-to-date and high quality multimedia teaching materials on six selected topics for vocational high-schools in Hungary, in the UK and in Sweden and that would also serve as models for further dissemination of both the particular teaching materials produced and this educational culture in general.

This paper is focussing on the step of testing working prototypes by our INTERFACE methodology. The studied multimedia piece titled "Electronic circuit conversions" has been produced by the Hungarian team of the Partnership. This CD-based product aims at supporting the understanding and the skills of application related to certain chapters of *Electronics* taught at professional secondary schools in Hungary. This case study illustrates the empirical quality assessment of this selected multimedia product by the help of the INTERFACE.. Figure 2 shows the result screen of the INTERFACE corresponding to a session.

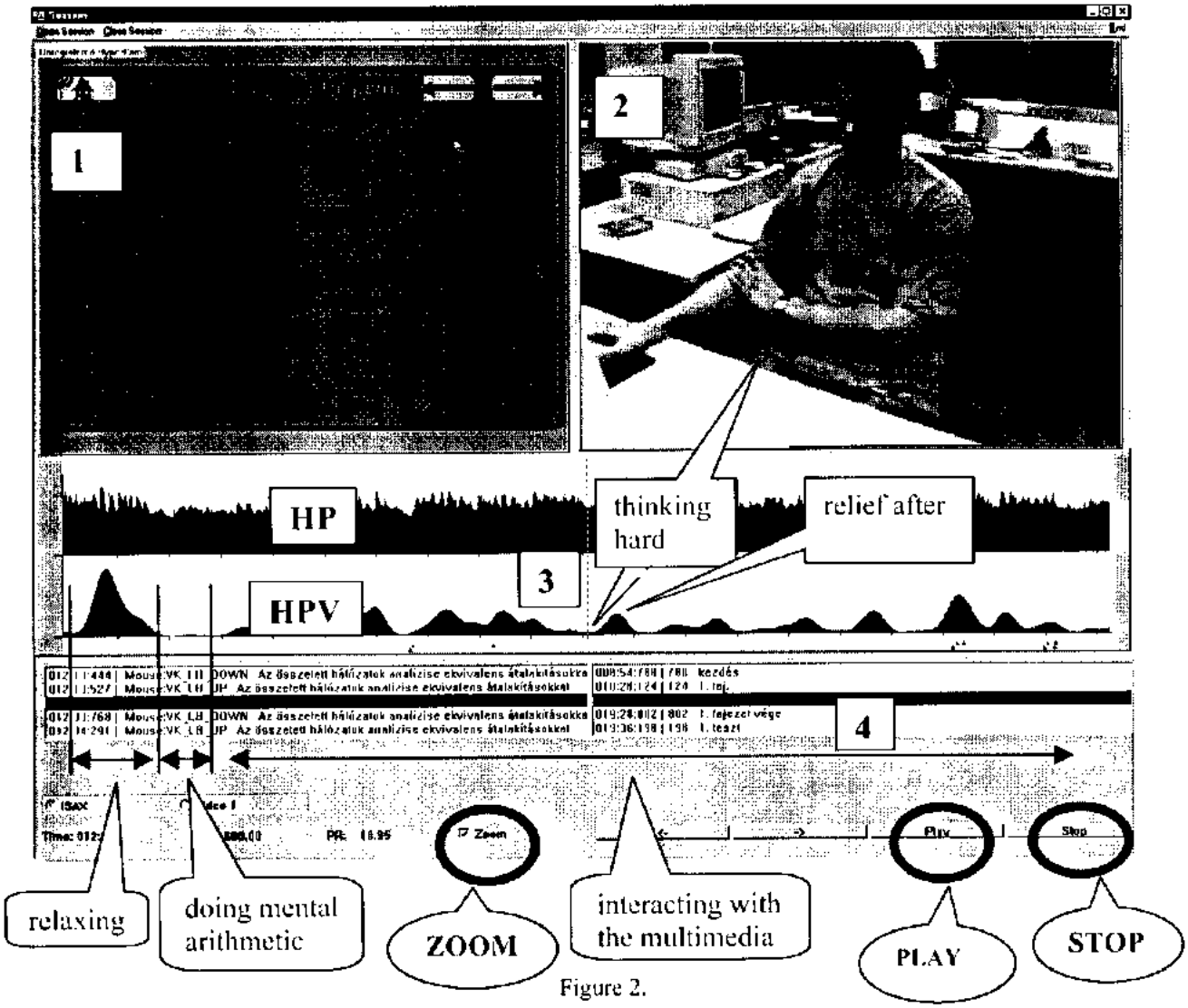

Figure 2.

The result screen of the INTERFACE assessing workstation.
The current screen content is seen in the top-left window (1), while the student's actual behaviour in the top-right window (2). These videos belong to the moment shown by the vertical dotted line in the time axis of the diagrams of physiological parameters (3). The upper curve in this diagram shows the current heart period (HP), the lower one indicates the current heart period variability (HPV). In text field below (4) the details of the interaction events (keystrokes, mouse clicks and experimenters' comments) can be found: the highlighted horizontal stripe represents the actual moment, the lines above belong to the past, the lines below to the future.

In the very moment represented by this actual screen the student is in the middle of interaction requiring problem solving and therefore also some amount of mental effort. As can be seen in the HPV curve, the actually invested mental effort is rather high (the HPV curve is suppressed to a high degree). The HP and HPV curves indicate the previous history of the interaction too: the session started with a 5 minute relaxation period followed by 3 minute mental arithmetic. In this case mental arithmetic means that the student counts down from a large number (say 11,789) by sevens in his head to induce mental effort artificially. These two activities represent the two extremes concerning mental effort invested and thus provides a possibility to calibrate the amount of mental effort to be invested later during interacting with the particular multimedia product. As can be seen, the HPV curve is rather high while relaxing, and is almost zero – that is perfectly suppressed – while doing mental arithmetic. The varying difficulty of interacting with the multimedia is represented by lesser or greater peaks, each of them corresponding to events interpretable in terms of task requirements and the knowledge available to the student. For

example the videos on Figure 2. show a moment relatively problematic to the student. If at that particular point of the interaction many other students with similar background also experience difficulties, we may have reason to believe that we are facing a design error. This way the INTERFACE methodology – Izsó and Antalovits (1996), Izsó (2000) - can distinguish between design errors manifesting themselves in frequent systematic errors committed by many students in the same or similar way, and real user errors committed only occasionally by a single student, or by just few.

In the result screen of the INTERFACE we can use the ZOOM, PLAY and STOP buttons to analyse certain events in more detail. An essential feature is that since all recorded parameters are tied to each other – "anchored" - and synchronised in time, during playing a set of recordings we can study the dynamics of all these parameters simultaneously as a function of time.
Based on carefully designed sessions of ten students by this methodology several weak points of the studied "Electronic circuit conversions" multimedia product have been identified. Some examples of these are

- not properly formulated tasks (some tasks proved to be too ambiguous or underspecified),
- misleading tasks (some other tasks targeted solutions different than the students were thinking of),
- not informative feedback (after problem solving some message were too laconic, e.g. "not correct")
- poorly legible pieces of texts in certain screens (too small letters, unfortunate text-background colour combinations, or too low contrast),
- too sketchy figures (some circuit schemas were not as detailed as the students expected),
- etc.

These finding were fed back to the developers – including both teachers and program designers - and were redesigned. Assessing the redesigned version is just being done.

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"HOW WE WERE" - A WEB SITE OF THE SOCIAL HISTORY OF CHILDHOOD MADE BY CHILDREN

MULTIMEDIA FOR KIDS - MEDIAKIDS

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Abstract

"How we were" is a web site, develop into the European project Mediakids, that treats about the childhood history in Europe during this century. It's a site where participant children should fill in of contents, with their own contents. The main goal is that pupils investigate about the social history of childhood with the aim of share the information with the rest of the participants, develop of the knowledge construction. In this paper are presented the main ideas of the methodology contents of the web site that it's being implemented in 30 European schools.

The project

"How we were" is an Internet multimedia environment about the history of childhood in Europe - http://www.lmi.ub.es/mediakids/hist-, with some CD-ROM based resources. This environment implies a high level of communication of schools involved either at national or European level. The environment is composed of elements and tools as well as methodological suggestions that teacher and students could integrate freely into their own curricular design. The CD-ROM offers multimedia elements -e.g. tools, samples as designs, video sequences, and sounds- compiled by schools that participate in the project.

"How we were" has been develop inside an European project, co-ordinate by A. Bartolome, it is title Multimedia for Kids. The project will evaluate the design, development and integration of multimedia materials into instruction processes through two parallel conceptions. The objective of the research is not to compare both ones but to analyse how end users participation in design and production process affects the final integration of products, and how two different multimedia designs could be integrated in current educational environments.

The web site "How we were"

It's a work tool that has to be realised by the students together with teachers for build the social history of childhood made by children. "How we were" is organise in different items, each one with an specific functionality:

In the section **Introduction of data** information is introduced into the database. The information is entered by filling in a form and sending it to the server with pictures, draws, sounds and texts related to the propose categories.

The section **Access to data** allows information to be extracted from the database that matches search criteria.

The section **Cards introduction** allows you (by filling in a form) to introduce observations and conclusions related to work carried out with the data base

The section **Cards access** gathers together notes made about work done on the MediaKids site, observations and conclusions related to the sessions make in the classroom.

Activities: start some games and activities that let use the data base, interchange information between schools and enrich the knowledge about the childhood history.

The section **Methodological proposals** is directed at teachers and aims to facilitate work with the database in the classroom by offering different didactic proposals..

The section **Communication tools** allows access to the different resources and systems of communication between schools, teachers and countries.

The program has a **Demo** that helps you to understand the functions of the different sections.

Methodological bases of the history web site

The initial research of the MediaKids project team was centered into the place of historical enquiry in the national, and in some cases, regional curricula of our six partner states.

The conclusions of this document (can be found at http://www.lmi.ub.es/mediakids/management/reports/deliverI/history/index.html) were used as a base for the follow design and develop of this educative web site. Here we present the main ideas refer to the place of history in the curriculum that have been use as a base for the next development of "How we were". Here we present the results of the research.

- Leinhardt et al. (1994) concluded that history is "a process of constructing, reconstructing, and interpreting past events, ideas, and institutions from surviving or inferential evidence to understand and make meaningful **who and what we are today**...". That makes that we design a work environment where children develop a sense of their own understanding different events close to their own context.
- There are key developmental issues in the teaching of history relate to children's problems in grasping the fundamental concepts of change over time. Further it has been argued that children, within the age range under consideration here, need imaginative frameworks in order to enter into historical worlds and **historical thinking.**
- As one of the main problems in the previous research was that students in different countries have problems to grasp **change over time**, to understand evolution, our design has emphasised this point. Every data introduction will have to be matched to one year (from the beginning of 20th Century until now) and to one age, out of four (that is "We", "When my parents were children", "When my grandparents were children", "When the 20th Century was a child"). Every school will have the possibility to stress in one or in the other.
- In the most of the european curriculum, history subject is worked at a local context. Nevertheless, it is known that the identity sense is not acquired only attending the own context, but it is important to understand the european and world dimension. That is the reason why the Mediakids web site makes possible to build a data base between children from diverse European countries. These children may compare not only the documentation, but also their conclusions, points of view, feelings, experiences... with the rest of participants so as to learn the **multicultural local perspective**.
- Most of the participants learn history as an **interdisciplinary** science, that is, they do use more than one discipline to reach the objectives. That made us create eight different themes about history, How we played, How we studied, How we worked, How we dressed, How we moved, How we celebrated, How we lived, How we ate. This eight themes are easily connected to disciplines like politics, social, arts, science... and to the cross-curricula themes. It is important the teacher adapts this material to their own way of teaching.
- Most commonly used **learning strategies** in primary schools are linking subjects to meaningful contexts, linking past to present, using stories to explicit causes and consequences (Levsrik, 1989). MediaKids web site was developed bearing in mind all these strategies: linking facts to generations, expressing conclusions to others using their own language or a foreign one, or even drawing a picture...

The project foments the history comprehension, the learning of some information technology (it's necessary to have a control of the access, to transfer files...), the expression practise and the comprehension of write text (sometimes in foreigners languages), the plastic expression and the read of the image. The understanding of an image will be a key element to share information with the rest of participants.

The project intends to be as much open and flexible as possible, so as to let the teachers use it in the way their context and their curriculum allows for. The project pretends the methodological innovation from the teachers asking them to summarise their new experiences to share with all the participants.

Results of the implementation of the project

"I think that with a map of Spain I have enough to mark all the places were my grandparents have been, with the European map I've enough for my parents and I need a world-map for me". This is what Ana of 9 years old, of the Senara school of Madrid, comments to her teacher the morning when she gives a map of Spain with the routs, in different colours that their grandparents, their parents and them have been done at the age of 9 years.

This is one of the curious event that have been happen in the implementation of the web site in one of the participant schools. With this example we want to explain one of the activities that can be done with "How we were" and the reactions always surprising of the students.

The project is in a phase of processing collected data during the first phase of implementation that have been done with some schools of different European countries. Although, in the meetings that we have been take by the consortium (universities, companies and schools) and the visits to the schools during the work sessions of the pupils, we have realise that teachers and pupils show a lot of interest by this work tool. Teachers explain the happiness of the children investigating and observing after their stories and draws hang in the web. Also remark the change of methodology that it's necessary to build history in that way.

More information

About the project:
http://www.lmi.ub.es/mediakids

The web site "How we were" can be visit in:
http://www.lmi.ub.es/mediakids/hist

For any other question ask to:
mediakids@lmi.ub.es

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LECTURES ACROSS THE OCEAN. LONG DISTANCE LEARNING IN PAM CENTER

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Introduction

Long distance learning has had a long tradition in the West. Advances in technology and access to new communication techniques have created new ways of offering educational programs. Radio, television, telephone networks, and finally the Internet have contributed to the development of new ways to build a society of learning people.

In Poland advances in long distance learning have also taken place. For instance, the School of Correspondence Education and Training in Poznan has for many years offered various correspondence courses. Distance learning programs offered on radio and television during the 1950's and 1960's were popular country wide. However, it is true that in Polish universities, long distance learning is not as popular as it is in American universities and colleges. Also, Poland does not have a national institution like the Open University in England or the University of Hagen that offers the opportunity of distance learning for all Polish language students. But during the 1990's a chain of centers has been established in Poland with the financial assistance of the PHARE program (such as in Cracow and Gdansk) to prepare and put long distance learning programs into effect.

Distance learning programs have also been established in Lodz. In 1995 a collaboration between the Faculty of Management at the University of Lodz and the R. H. Smith School of Management at the University of Maryland (USA) established the Polish-American Management (PAM Center). A grant from the United States Agency for International Development (USAID) funded the project. PAM Center activities include the development of study programs and training in the use of long distance education. Courses are also offered in management and manager personnel training which the use of distance learning technologies. Technical facilities at the PAM Center and the University of Lodz support these distance learning activities. The following text presents four years of experience in this scope.

Appropriate technologies installed in the PAM Center to support the education process include a voice mail system integrated with the university telephone exchange, videoconference equipment (Concorde 4500, SwiftSite by PictureTEL) cooperating in an ISDN network, adequately equipped classrooms/lecture halls, a computer laboratory with quick Internet access, semiprofessional equipment for video archives and post editing, and Internet servers (WWW, WebCT, BBS). Each student and training participant has access to multimedia workstations, peripheral equipment, and the Internet.

Videoconferences: Lectures Across the Ocean

The main service offered by the PAM Center is a two-year postgraduate study program called the Executive Masters of Business Administration (EMBA). This program is meant for senior management personnel. The fifth edition is now going on.

Joint Polish-American cooperation provides that 20-30% of the classes are conducted by American faculty. These joint classes are co-taught by American and Polish faculty. The American professor usually comes to Poland once, at the beginning or end of the semester. The remaining meetings are conducted by videoconferencing, meaning that practically every week during the academic year videoconferences between Lodz and Maryland take place.

Application of this technology was a new experience not only for students and teachers from Poland, but also for lecturers from the USA. Lectures across the ocean are completely interactive; both sites can see and hear each other very well. Questions are asked and discussions are carried on, generally with the American lecturer on one side of the ocean and a group of Polish students on the other.

Other types of classes also take place across the ocean. A very interesting meeting took place between a group of students from Lodz and students in Maryland. They conducted a joint case study to solve a communication problem. Lodz students in a Management Information System class presented case solutions to American students, with faculty behind the scenes assessing their work. Polish students think highly of such classes because they give students access to experts from a famous university. It is also a convenient way for American faculty to cooperate with Polish students, which does not mean that they do not like direct contacts with students or visits to Poland. But the time requirements and costs of videoconferencing are much less than a trip across the Atlantic. Up till now, bills for the ISDN links are paid by the Americans, where the cost for international connections are lower, who are then reimbursed by the Polish side.

The efficient working of the Lecture Across the Ocean classes is due to the joint technical and organizational cooperation by both sides of the venture.

- A person on either side is responsible for connections functioning smoothly. He or she is responsible for the session's terms settings, testing connections,
- Proper preparation of the classroom/lecture hall (lighting, sound) and support equipment.
- Lecturers send didactic materials be email or fax before the long distance learning class begins. These may include PowerPoint presentations, auxiliary texts, case studies. Depending on the need, presentations may be reproduced in Lodz simultaneously with the lecture; other times they are demonstrated directly from the USA. For some American partners, this meant additional work—the need to prepare electronic presentations to replace the traditional blackboard lecture, which turned out to be illegible and hardly dynamic.
- Video lectures require special preparation. Videoconference rules are the same as those for television. Apart from the content-related part of a lecture, faculty must think of proper attire, interactive aspects of the class, brakes,, even jokes necessary to keep the students' attention.
- Classes are videotaped for students who can not participate in some classes. The tapes are made available to the students. In a few cases, taped meetings were transmitted on the Internet via RealVideo sever mediation.

At present, connections are made via public digital telephone network ISDN. This solution is much cheaper than flights from the USA to Europe, yet it is still expensive. The PAM Center keeps working on using the Internet as a medium for transmitting video signals. We are talking about transmitting signals on 1Mb/s level at long distance for a relatively long time (video classes last about two hours). It requires special preparation by the Internet services providers with a combination connection between two locations with the use of broadband network abilities. Poland has network POL 34; Western Europe has TEN 155; and the USA has a structure called Internet 2. Videoconferences between the USA and Poland - that are currently (October 2000) tested - will probably be the first attempt of using modern technologies for educational transmissions. The attempts at connecting on the university local area network were auspicious, the same as in metropolitan area network LODMAN in Lodz. Connections between two metropolitan area networks within the POL 34 network also succeeded. (In May 2000 we took part in a video conference with Poznan, about 200 km from Lodz.) The attempts of using the videoconference server installed in Lodz also finished with success. In the future it will make multipoint connection combinations and teleconferences between many centers through an IP network possible.

Global Mini MBA™ – Manager's Training Through the Internet

For people who can not take up EMBA studies for many reasons (lack of time, insufficient knowledge of English) and yet need some marketing knowledge, we offer short courses. The most popular is Manager's Study Mini MBA. This program (about 120 hours) includes the following subjects: Organizational Behavior, Financial Accountancy, Strategic Management, Management Accountancy, Marketing, Finance and Capital Markets, Law of Labor, and Management Information Systems.

The program includes lecture courses, but also practical classes like task solving or case study. Time is also devoted to discussion and exchange of experiences. Many students are representatives of large companies. Faculty are university lecturers (from the EMBA program) and famous consultants in various fields of economic life.

Eleven editions of the Mini MBA program have already taken place, one recent one in Warsaw, as lecturers commuted there from Lodz. The great success of this program has caused interest in developing an Internet version. It would then be available to students from other regions of Poland who for the lack of time can not travel to Lodz to study in the traditional way (two afternoons a week for 12 weeks). It was decided that the Internet version of the program would have to be a close to the original version as possible. It would have the same subject and material scope and the same lecturers. Internet students would devote more or less the same number of hours for learning as do students in the PAM Center classes and use the same textbook (with additional texts if necessary).

In the first offering of the distance learning version of the Mini MBA, course Internet pages were created for making video materials available, but as it turned out, students' access to the Internet in Poland was not enough. For the following reasons, internet system WebCt was chosen to execute the project:

- The WebCt system contains the complete environment for long distance learning (schedule, WWW pages on which program texts can be placed, electronic mail and discussion forums, tests, quizzes, and other tools).
- It is relatively easy to use: both students and teachers use the system through WWW pages.
- It has low license cots (program license lets user set the number of participants and time the course would last).
- It allows at least partial localization of the user's interface.

Seventeen people from all regions of Poland finished the distance learning program. Participants judged the delivery method positively. The next edition is currently going on, and we are recruiting volunteers for other editions. It is the first such comprehensive Internet study program in Poland.

Long Distance Learning for Teachers

New technologies installed in the PAM Center and experience gained with them were the impulse for starting at the University of Lodz Postgraduate Principles of Long Distance Learning Studies. These Studies are organized in cooperation with the Faculty of Educational Sciences and are meant for teachers, administrators, and education organizers who intend to use new technologies in their work. Students become familiar with a wide range of educational issues, theoretical and practical, connected with long distance learning. The program includes the following subjects: long distance learning technologies/techniques, psychological and pedagogical aspects of long distance learning, communication, teacher's role in long distance learning, methodology of long distance learning, organizing and administrating with LDL programs, and law problems.

During practical classes, student-teachers create programs for different subjects adapted to long distance learning. They learn how to prepare long distance learning class scenarios, how to use Internet applications for LDL (BBS, WebCT), and how to prepare and run videoconferences.

This is a unique program within the whole country, as was noted by the Department of Education, which for the second time granted means for teachers' participation in the program. Currently the fourth edition is going on. At present traditional classes are held, but in the next year an Internet version is planned.

Conclusion

There is not doubt that experiences in programs using long distance learning in the PAM Center will be helpful in creating new educational programs at the University of Lodz as well as at other universities (technical, medical, etc.). Experiences with similar initiatives in the West shows that universities and educational institutions can cooperate with each other. They establish consortia for creating and using

shared resources. This is the way regional centers supporting long distance learning, offering courses through the Internet and educational television (including cable TV networks) come into being.

In Poland the idea of long distance learning needs popularization. Means for creating educational programs and some organizational problems (LDL program financing, accounting the work time of academic teachers) need to be worked out.

Universities and educational centers running post-graduate studies, training programs, and professional improvement courses via long distance learning will be successful in providing attractive educational offerings to people busy with work and raising children, or who are handicapped or living far from large cities.

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DIGITAL SCOTLAND
A SMALL NATION WITH LARGE AMBITIONS

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Abstract

This paper considers the experience of online learning in Scottish schools, developed as part of the National Grid for Learning initiative. It begins by setting the political, educational and technological context, proceeds to describe the major ICT initiatives in Scotland, offers examples of digital educational content development and discusses a case study of opening the classroom using e-learning. The paper focuses on school-based education and the examples are based on work with secondary school pupils and teachers.

Introduction

On May 6 1999, as the millennium drew to a close, one of Europe's oldest parliaments was restored after a gap of almost 300 years. Rooted in history and tradition, the Scottish Parliament is a vibrant product of the Information Age as Scotland and its people face up to the challenges and opportunities of the digital revolution.

The Scottish Executive, the government in Scotland, has statutory powers for all matters devolved from the United Kingdom Government, including education. Responsibility for administering Government policy for education lies with the Scottish Executive Education Department (SEED) [1]. SEED works with Scotland's 32 local authorities responsible for providing school education in their geographical areas. There are 745,707 (431,414 primary; 314,293 secondary) pupils in 2,682 publicly funded schools (2,293 primary; 389 secondary) in Scotland [2]. The percentage of schools in Scotland funded by the state is almost 95%. SEED advises Scottish parliamentarians and government ministers on all matters related to school-based learning. It is responsible for targets for government initiatives in information and communication technology (ICT).

ICT Initiatives

The National Grid for Learning (NGfL) is a United Kingdom initiative that aims to ensure that schools, colleges and public libraries will be connected to a network of useful educational resources [3]. Scotland aims to achieve the following targets by 2002:

- all Scottish primary and secondary schools will have a minimum 2Mb broadband connection to the NGfL;
- all Scottish teachers will have been trained in using ICT in their curriculum area;
- all Scottish pupils and teachers will have their own email address [4].

In Scotland, the strategy and targets for the NGfL initiative are determined by SEED, and a team of NGfL specialists are led and managed by Learning and Teaching Scotland (LT Scotland), a non-departmental government body funded by SEED. LT Scotland was formed in July 2000 following a merger of the Scottish Council for Educational Technology (SCET) [1] and the Scottish Consultative Council for the Curriculum (SCCC) [1]. LT Scotland is working with commercial and public sector partners to develop the NGfL Scotland web service. Working in partnership with the Scottish software industry, LT Scotland hopes to achieve the target of making Scotland a centre of excellence in digital educational content.

The Scottish Executive has ambitions to make Scotland a digital nation. Indeed, the NGfL emerged at the same time as Scotland's attention was focused on the creation of the Scottish Parliament. It was boldly stated that the grid would "grow to provide an ideal vehicle for Scottish people of all ages to have access to education and information about the Parliamentary process and its outcomes. By promoting

understanding of citizenship and the issues surrounding it, it has the potential to strengthen the democratic process." [4] This belief is witnessed further in the establishment of the Digital Scotland initiative. This initiative, overseen by a Ministerial Committee and chaired by the Minister for Children and Education, aims to ensure that Scotland obtains and retains maximum economic and social advantage from ICT. A task-force of experts from outside the Executive advised on specific issues and produced a report with recommendations on the way forward [5,6]. Taking forward the recommendations in the report, the Scottish Executive appointed Scotland's first e-Minister, Peter Peacock, also Deputy Minister for Children and Education, in September 2000. His role is to realise the opportunities presented by the digital school and further commitment to the digital school and the scope of (r)evolution is evidenced by the establishment of a *School of the Future* branch of SEED.

Resourceful

A small nation of only 5 million people, Scotland has a reputation for being resourceful. In 1998, although the vast majority of Scottish schools were not yet connected to the Internet, SCET (the national ICT agency that merged into LT Scotland in 2000) created a CDROM Series, SCETNets, which brought web resources into the unconnected classroom.

The SCETNet series of CDROMs acts as an introduction to using Internet resources in the classroom for specific subjects including Modern Languages, Business Studies, Media Studies, Chemistry, English and Communication, Art and Design, Food Technology, Physics and Geography. They are aimed a secondary school students aged 14-18 and support a new implementation of the curriculum for this age-group. Because the SCETNets support both teachers and students, the metaphor employed on the CDs is that of two distinct areas, the Classroom and the Staff Base:

- the Classroom area contains student activities written by a subject expert using relevant resources on the web (which were then stored on the CD). For pupils, the practical activities in the classroom area enable them to work independently and explore resources and other sites on the Web (if they have an Internet connection);
- the Staff Base area contains support materials for teachers. In addition to the student activities, teachers can access information on the web sites used on the CD, curriculum relevance of the activities, other relevant sites accessible via a live Internet connection, online newspaper articles relevant to their subject and access to Scottish curriculum guidance materials.

To enable teachers and pupils to use these web sites from computers not yet connected to the World Wide Web, SCET obtained agreement from the owners of the sites to download their web pages to the CDROM using the same links, structure and navigation used on the original site. Teachers and pupils then had the opportunity to:

- access curriculum-relevant web resources, otherwise not available to them;
- learn to navigate web pages using browser software;
- develop the research skills to use web pages effectively.

The SCETNet series has been successfully used in many Scottish secondary schools, and will continue to be useful for classrooms where Internet access is still not assured. However, an increasing numbers of schools have access to the Internet (49% of primary schools, 97% of secondary schools), and there is a corresponding increase in the demand for web-based educational resources.

Putting the SCETNets Online

SCETNets Online [7] is a NGfL project funded by SEED that put six of the SCETNet CDs online, enabling students and teachers to harness the power of the communication facilities of the Internet. PIONEER, developed by LT Scotland, is a protected, integrated and easy-to-use web-based learning environment. It includes email, activities, and a threaded discussion forum. Only students and teachers can get in to PIONEER, ensuring that the focus is on learning. SCETNets Online enhance the CDROM versions by enabling teachers and learners to take part in online discussions about the subject. Students have access to activities and discussion forums but not to teacher resources. Teachers can create new

activities and submit them for inclusion into the online version of the SCETNet, increasing the number of activities available for use by teachers of the same subject throughout Scotland.

E-learning – taking learning beyond the classroom

70 million people across the world are currently learning online via the Internet. Virtual universities, colleges and even high schools have emerged in many countries, enabling students of all ages to learn at a time, place and pace convenient for them. Over the next 30 years the United Nations Development Agency estimates that as many people will be seeking formal educational qualifications as have done since the dawn of humankind [8]. Online learning is regarded as essential to exploit the potential of ICT for learning and is central to the success of lifelong learning initiatives such as the Scottish University for Industry (SUfI), another government ICT initiative which aims to connect people and businesses who want to improve skills with those who can offer training.

Negotiating the Treaty of Versailles – Online!

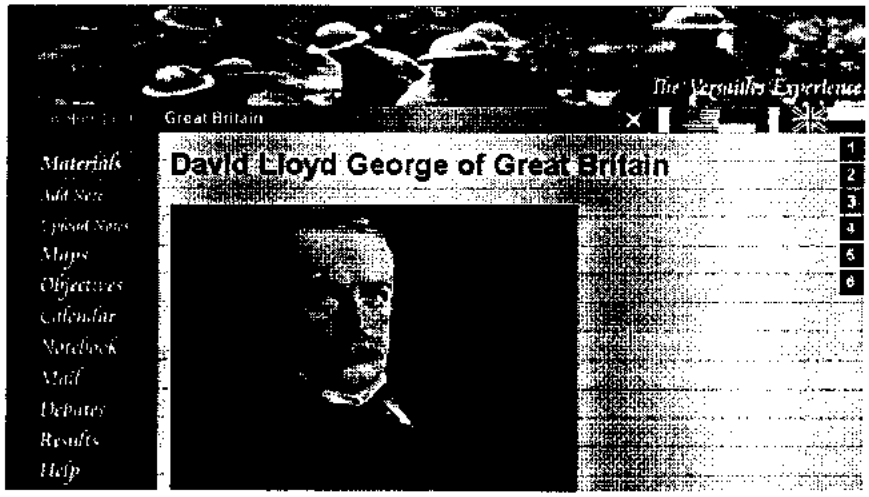
During October and November 1999, 39 Scottish, 19 English and one Indian school participated in an online re-enactment of the Treaty of Versailles 1919. The Versailles Experience [9] was designed around 4 weeks of collaboration and role playing, with one day of negotiation on 11th November 1999 – all of which took place online. It was aimed at 14-16 year-old secondary school students. Each school organised pupils into six groups, one for each of the countries involved in negotiating the treaty: Great Britain, USA, Poland, France, Serbia and Italy. Pupils were encouraged to role-play and to argue from the point of view of their adopted country in 1919. They then collaborated with the same country group in other schools to reach agreement on how the German Government should compensate for the damage done in World War I. Pupils were encouraged to explore the site to find out what their role was, assess how the negotiations were developing, and establish what materials were available to them. Students and teachers were encouraged to upload their own ideas and materials in the 2-week run-up to the talks. In the post-talks period students had the opportunity to disseminate what they had learned and to produce web based materials in the form of national perceptions of what the treaty meant to each of the participating nations. In the pre-negotiation period participants were arranged into six national negotiating teams, with each participating school being given 6 passwords - one for each country. Each school then created groups of students associated with each country and these groups in turn had access to the nation-wide groups. In these nation-wide groups each team required a copy of its own national objectives and those of all the other countries. Ahead of the actual negotiation, national teams:

- became familiar with their country's objectives;
- decided on priorities;
- became familiar with the objectives of the other countries;
- identified possible negotiating strategies.

The teacher assumed the role of Recorder and those involved reported all decisions agreed between negotiating parties to the Recorder.

Design of the learning environment

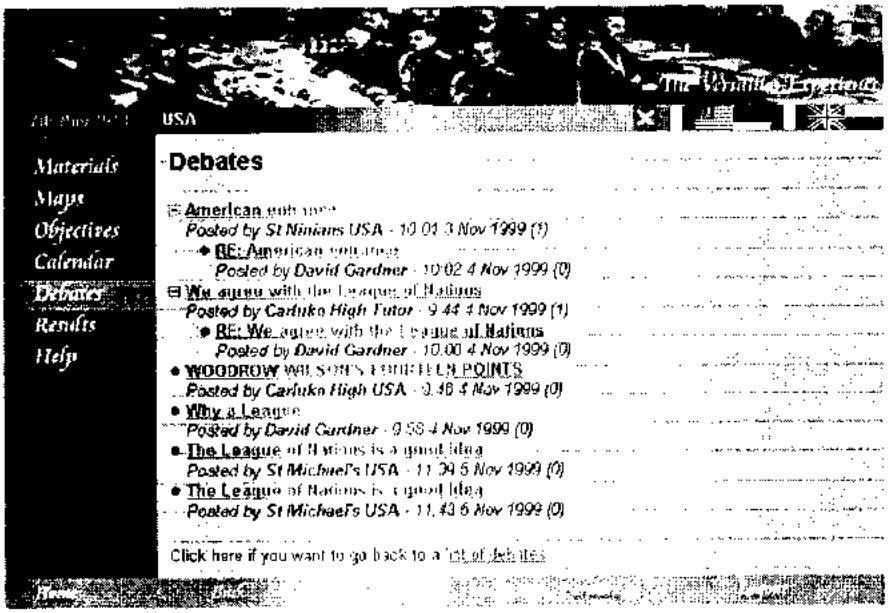
The Versailles project was delivered using PIONEER, an online learning environment developed in 1997 by SCET, one of LT Scotland's predecessor organisations. Only schools signed up for the project could access the environment and within it only recognised pupils and teachers could make contributions. To support the role-play aspect of the experience, the graphical look of PIONEER was designed to capture the mood of the time. The colour scheme was a sombre khaki green and harrowing black and white images of WWI were displayed across the top of every screen, contrasted vividly with a bright red poppy displayed on each of these photographs. To encourage a sense of time and place the date at the top left-hand of the screen changed daily with the year depicted as 1919 instead of 1999, again to create the feeling of 'being there'. The flags at the top right-hand depicted each of the countries negotiating the treaty. When pupils logged in they only had access to the country they were representing; teachers had access to all countries. Down the left-hand side of the screen were the tools that pupils and teachers used for debating and collaborating.



- **Materials** offered background information about each of the countries as well as a link to a useful web site on the First World War;
- **Maps** represented Europe in 1919 and all the major areas referred to in the negotiations;
- **Objectives** described for each country to achieve. Tutors were able to provide feedback to pupils here;
- **Calendar** of key events in the 4-week project;
- **Mail** offered an easy-to-use facility to communicate privately with other participants;
- **Debates** was a discussion forum area that enabled pupils and teachers to discuss and debate the objectives for their country;
- **Results** demonstrated the results on completion of the negotiation;
- **Help** described the aims and objectives of the learning activity as well as guidance on the tools listed above.

Discussion

At many times during the Versailles Experience over 100 people were logged in simultaneously, although the online activity was essentially asynchronous. In a 2-week period 363 contributions were posted to the Debates discussion area, the vast majority by pupils. Of these, only 3 contained irrelevant or inappropriate material. Considering that pupils could not be identified individually by the user-id they logged in as, this is a tremendous testament to their responsible and mature approach to the online learning experience. It also demonstrates that where online activity is focused and fun, little time is wasted on 'messing about'. When a similar project was implemented two years earlier using a chat tool on the *wider* Internet, the online discussions rapidly deteriorated into social chit-chat. Although some positive outcomes were achieved, the history teacher who co-ordinated the project, had little intention of using the Internet again for this type of project. In PIONEER, he saw the opportunity to focus the debate and was delighted at the turnaround on the quality of online discussion on this project, a complete reversal from his previous experience. On Thursday 11 November 6 summits were created in the Debating area. These were open to all countries and the intention was to discuss, negotiate and agree on outcomes.



Serious learning, hard fun

The overwhelming response from the pupils who took part in the Versailles Experience was that it was fun and that they learned much from it. Pupils from Auchterarder High School shared their reflections. In response to the following questions, they said:

- Did you enjoy it?
  "It was fun and educational at the same time."
  "I really enjoyed emailing people when you wanted to reach a common objective."
  "Overall I feel that the day was a success, can't wait for the next one!!!"
  "All in all the experience was well worth it and I recommend it should be repeated next year so others can share the fun and learning!"

- What did you enjoy most?
  "The fact that I could speak to other pupils round the country from different schools was brilliant! I discovered that everybody's view and interpretation of what happened was extremely different from mine!"
  "It is difficult to point out one specific aspect of the experience which I enjoyed most as it was all extremely good."
  "I enjoyed speaking (occasionally arguing!) with pupils from different schools. Often I found that their interpretation of the facts differed from mine."

- How did it help your learning?
  "It helped with my learning as it improved my debating skills, it gave me a chance to hear other people's point of view ... and it helped me remember some facts and taught some new ones!"
  "Having to argue my point of view, and thinking about the treaty from America's point of view helped me to understand more of the treaty and hopefully to remember it! Hearing other pupils' opinions made me question my own which helped to dispel a few bogus facts that had made their way into my head."
  "I really learnt a lot on this programme. It has a lot to do with co-operation between other countries. It was very beneficial, and I feel my knowledge has greatly improved."
  "I found the event to be extremely beneficial in terms of my learning."

Conclusions

This was the first collaborative, role-playing online activity in Scottish schools using a virtual learning environment. It demonstrated that online learning, even when designed around a largely textual computer conferencing element, can work well with school students. Among the reasons for its success was the

time-bound nature of the experience and the clear learning objectives established at the outset. One of the interesting lessons learned was that of a shift in the relationship between the teacher and pupils, with pupils 'taking over' and teachers 'unsure of their role'.

The Versailles Experience resulted in some significant learning taking place, and not only about the subject matter. The comments from the pupils above clearly demonstrate that the development of cross-cutting skills, or emotional intelligence [11], such as empathy, the ability to listen to others, question your own knowledge and understanding took place. It is also obvious from the pupils' comments that serious learning and hard fun [10] are not mutually exclusive.

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ICT AT SCHOOL – NOT FOR EVERYBODY

Rigmor Sterner, DE-consultant

Background

At a meeting with a group of teachers at a Swedish compulsory school following statements and questions arose, which did not really surprise me, but I had not believed there was such a lack of knowledge about ODL.

- Don't talk about DE. We do not know what it is and means. Talk about IT and why we should use computers at school. This is above our heads. This should have been told our headmistress, the politicians and the officials.

- Why have we not heard this before? Why are the officials not here? How could this be realised at our school, when we don't have knowledge about it? How could we do this when we don't have adequate equipment, and the cost reductions are too heavy on our schools? From where could we have knowledge about this without any costs?

I have met teachers, heads of schools and other people engaged in education, who have not yet come across DE, ODL or flexible learning. I have also met those who say they have introduced and work in the name of DE, ODL or flexible learning, but in fact don't. It seems as if there are two groups of education providers, who do not speek the same language, and worse, seem to live in separate worlds. Too many talk about DE, but do not really practice what they preach. This includes the authorities as well.

Teachers are not ready, yet, for the (re-)volution, as they lack information about what ODL and new methods by using technique mean for teachers, pupils, organisation and politicians. They have not been introduced to the pedagogy and methodology of ODL. They are given some or few opportunities to learn how to handle different computer programmes.

Why is it so, if the Department of education say they dump money into the development of DE? Why had these teachers not got proper information about ODL, and why did they show such a negative attitude to ODL? Have we not come further, or has information about DE and ICT only penetrated to a very few education providers and teachers?

These teachers at the meeting, however, showed not to be the only inexperienced and ignorant people dealing with education, when talking about e-learning and open classrooms. Could the area of living, the schools, costs or the attitude of their heads and officials be the reason? Some answers are presented here. Some questions are still waiting for an answer.

Attitude canvassing and information diffusion

Receiving basic knowledge about DE is evidently not for every man. What it means for teachers, pupils, and organisations is still undiscovered grounds. What DE could provide for a change of didactics and a know how about technology in education is still a waste land at many schools and among many politicians and local education committees. Politicians wish to reduce the costs of education, and talk about DE as *the* solution. School officials think they have succeeded with ODL and flexible learning, when they have started the Internet at a village school. Projects of different contents in the name of DE are spread by project leaders who have little or no idea about pedagogy, methodology, demands on organisation, teachers and students or of what value technology could be for learning in the digital world and DE.

Teachers, heads of schools and members of local education committees in this study have showed to belong to different "realities".

Reality 1:

Some people of each group are for ODL and flexible learning, and have already started with small steps towards a good solution of a pedagogical and methodological dilemma. Although there is little money to purchase technique, programmes or their own competence development, they have for instance taken their pupils to computer courses provided by other institutions than their own school, and they have started co-operation with other schools in different subjects. Some, on the other hand, are against any talk about DE. They could accept more information, though, about IT and what IT at school could be of value for their work, as they are more or less forced to learn about one or two computers programmes, particularly how to use Internet. Costs and reduction of school costs are over-shadowing their work. They do not feel free to work as they would like to, when they realise there could be some openings and introduction of new ideas and ways of learning for their students.

When looking at the ICT development of the whole country it seems as if the situation does not differ too much between different living areas. As expected, education providers, school boards, officials or teachers with a profound knowledge about what DE and ODL really is and means have come further and given opportunities to make investments in competence development and technology. Still, we see that the living area means a great deal. Rural areas are less provided with technology and knowledge about ODL. When turning to adult schools, providers of short term courses for adults and evening schools, they are even less prepared for another way of teaching. There the cost is the biggest hinder for both personnel and technology development.

Reality 2:

Those in charge of education are often missing at meetings dealing with ODL. Many officials are interested but have no time, they say. They also say it is important and they realise there could be a lot to do which could give a positive feed back to the organisation. Yet, they withdraw when it comes to money and investments. Shortage of time is also obvious. Ideas about teacher's training among teachers, headmasters, and officials are discussed, but seem to fall between the stools. Once again there is an unaccepted cost.

Evident is also the attitude towards changes. The teachers know what they have, but not what they get, and they are not allowed to fail. Working in "teacher's teams" also seems to prevent them from approaching ODL. They say they have no need for DE or ODL.

Reality 3:

Unexpectedly, the vocabulary of DE seemed to be unknown or difficult to understand. There are respondents who say they do not understand the language and the vocabulary when reading texts about DE. Even when "translated" they feel uncertain about the meaning of the words. Some expressions, though, are evident for most of them. They pronounce a fear of having to come across DE, when they realise they need to use their own teaching language in somewhat other way than they are used to in the classroom. How could they provide a study guide according to the theories like "tutorial in print" or "guided didactic conversation"?

Some have bad experiences from experiments of ODL or DE. The stress has rather often been too strong on ICT and Internet. The results were negative, and they felt both angry and used, as the students did not reach their goals with the methods they had used. So "Never again". When asked about teacher's training, they only answered with another question, "Who would pay and give time for that?"

Results

How to meet, attack, and change attitudes? How to give DE and ICT a chance to work together? How to introduce another way of thinking and working? How to make aware the possibilities among those who say they need, but cannot pay for the change (computers, programmes, connections, training, technical back up, etc.), and make the users (the pupils) not to destroy the machines?

Information tends to be given those who do not need it, to those who already have the knowledge. I call it "the inner-wheel syndrome". It is evident to start from the top. Challenge the top dogs and make them interested! Some say they work with DE. They use computers and let the children write letters to Mr. Clinton, and the children get e-mailed answers. The officials and the teachers then get credits for innovation at their schools. The lack of DE-competence does not seem to disturb them.

The teachers need basic knowledge not only about ICT but also about DE and ODL. They simply need information what it is about, a stress on pedagogy instead of technology, and what they could make out of it in the best possible way according to their work situation and budget. The heads are responsible of providing the best possible prerequisite of teacher's training. Requests must come from the floor about time and interest of partaking in teacher's training and further education in pedagogy and technology.

Cost reductions of purchase of computers and connections are necessary in order to reach those outside the population centres and far from study centres. The small education providers, such as evening schools, do not often have access to Internet, because of the cost.

The difference and gap between those who are pro and already adjusted to technique and pedagogical innovations, and those who are against is still remarkable. There is also a gap between those who are supported by their organisation and local education committee, and those who are set back because of lack of money and insight what DE and ODL could do to their development as teachers and education providers. There are those who are trusted and those who are not, when it comes to innovations and wishes to introduce and try new ideas. There are those who have "superintendents", who need to control, employers who are poor leaders, who dare not meet a staff who know more than themselves. I met teachers who did not dare to put their names out as they feared for loosing their job. There is also a difference between areas of living. Schools and teachers in rural areas seem to be less provided with teacher's further training and technology.

Summary

The study – where an inquiry and interviews were used – shows a sad result. There are too many good teachers in rural areas, who have little trust and belief in the quality of DE, which stems from lack of knowledge about DE. They have never tried, or have tried but failed, since they had not had basic training for DE and ODL. They also fear for the use of technique and the changing of their roles. "We know what we have, but we do not know what we get." The teachers and the providers do not know how to realise a course, and ask, "Support? What support?" Creating network is another barrier, which they find difficult. The main problem seems to be about money. There is no money for development. And there is no time. Administration, meetings, ordinary planning take too much time, and they do not get any reduction of teaching hours for introducing DE.

Teachers seem to have been robbed of their time to teach, to prepare for their pupils' learning. All is about how to save money, to reduce the costs. There is little about how to create a beneficial learning atmosphere for the pupils, the advanced as well as those with different handicap, those who work slowly, those who have particular problems at particular situations.

Teachers have learnt a little about computers, but not why and how to fill the programmes with learning materials. That other techniques also could be used at a variety of reasons and situations, they say they have no idea about, as the technology is not introduced to their workplaces.

I also found that the respondents seem to live in different realities, which include attitudes among themselves and their heads and officials, as well as costs. Their living area and lack of knowledge among those in charge of education also seem to be hinders for their competence development. Experiments made without basic knowledge what DE is and means have given bad results. Many teachers and heads do not understand the "language of DE", as it is a new learning for them. Some teachers ask about how to introduce another way of working, when the heads already have decided what to be done and how. Some ask about how to realise new ideas about learning and working, when the pupils cannot be trusted in using the computers and other technical equipment. Who pays for learning about another way of working at school, and where is the time, are two frequently asked questions.

The aim of this study was to give a hint about how this inequality could be levelled out between those who are already working with ODL and those who are not. To be interested is not enough if they really want to make changes. The officials and teachers need information, knowledge and insight about how, with what and with whom they should implement these changes of their schools. They need information from those who really know what DE and ODL is about and means for teachers, pupils, and institutions or organisations. The decision-makers of education at community and county council level should be the first to learn about DE, and then give priority to teacher's training, and adjust time and money to ODL and DE development at schools. This does not seem to be the case. Sadly enough, there seem to be too many who say they know about and work with ODL, but in reality do not. As the study shows so far, we might ask if they really want what they say they need and want. Without promoters among the school leaders we will never overcome the negative and sceptical attitude to DE and flexible learning.

The distance between those who are on the ODL train and those who are not is rapidly increasing. We could help them entering in order to create a good learning atmosphere for their pupils and a stimulating and dynamic workplace for their staff.

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INDICATORS OF THE OPEN, INNOVATIVE AND INCLUSIVE SCHOOL

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Pia Guttorm and Ole Hansen, Denmark

Introduction

The immediate problems for the European education systems manifest themselves in a number of symptoms, which can be gathered together in the following brief conclusions:

- the proportion of young people in a cohort who do not complete an academic education is too large, due to them leaving the educational system at some point along the way.
- there are too many people who apparently have insufficient qualifications to be able to manage their jobs, even though they have in fact completed their education.

These points must be viewed in context with the following phenomena.

- Prognoses from several countries show that there will be a shortage of qualified labour in a few years.
- Lack of qualifications will burden the social systems of communities.
- Lack of qualifications will be a factor, which severely limits opportunities for the individual and reduces life quality.

Generally speaking many of these problems seem to arise because of the insufficient flexibility and dynamics of the school, which find expression in the attitudes of the teaching staff to pupils. Pupils are looked at as, for instance, able pupils or less able pupils instead of being seen as diverse learners who can contribute and share knowledge and experience.

For the further educational development schools and teachers must be enabled to see diversity and different interests for learning as a natural reality and make any effort to develop positive attitudes and interest to learning, help pupils to gain skills needed for learning independently, help them to access information and develop so that the outcome will be better and deeper knowledge - at different individual levels and with different individual profiles.

These circumstances reflect the fact that we find ourselves in a transitional phase between an industrial society and an information society, where both society and the individual pupil make new and modified demands on the educational system. In future there will be a need for people with a flexible and creative profile, who are able to adapt to many different and possibly unknown patterns, while at present our educational system is structured to train people to fit into already existing and persistent patterns. Against this background there is a need for pedagogical restructuring, converting new knowledge into practice and flexible approaches in solving teaching tasks.

The vision of school and its teaching practice

In order to be able to solve future tasks, school must be able to act with forethought and be able to analyse its own development. School must be able to produce a "development plan", in which is set out a rationale for its qualifications through a description of the vision, the culture and the thinking upon which it bases its curriculum.

Indicator of an open, innovative and inclusive school:

a) The production of a development plan, in which the development of school is described, partly as a pedagogical vision and partly as a practice which reflects developments in the community and the necessary correlative changes in the curriculum. A description of this kind will promote awareness regarding pedagogical action and opening up of the institution towards the surrounding world.

It is important that teachers have a full understanding of the fact that school reflects society. For this reason teachers must be competent in being able to analyse societal developments, creating visions for the school, which correspond to this development, and converting the vision into practice so that this is also manifest in the curriculum.

Today it must be considered as a requirement and necessity that the vision and practical enterprise of school constitute a reorganisation which concretises a number of indicators of an open, innovative and inclusive school, which builds on human and professional values in both individual and shared developmental spheres. School must be able to describe the pupil culture and account for ways of tackling the development of the curriculum content within an individual and shared perspective, as pupils must be responsible for their own education; they must learn to find their own bearings, know their own identity and share a common responsibility. In order that this will function in practice it is necessary that pupils learn this feeling of responsibility in school, through fellowship and teamwork with one another. Pupils must, for example, have an influence on their own academic and personal development and be able to feel that they are able to make a contribution and learn from each other. In other words they must experience being part of a whole, but also being an individual.

It is a question of moving the focus away from the sorting of pupils in relation to a norm, towards an adaptation and modification of the curriculum so that the individual pupil's experience, interests, expectations, needs etc. form the starting point.
The starting point for flexible educational provision is the fact that the system/teacher focuses on the individual pupil and his or her needs. The code words here are:

- analysing the pupil's potentials, interests and competence
- co-operation between teacher and pupil on content and goals
- results of the individual in relation to the set goals
- assessment of the individual pupil's progress
- differentiated teaching
- organisational differentiation

Thus, in basic terms, flexibility in education is a question of creating new ways of aiding pupils in acquiring knowledge and qualifications - using the proficiencies and possibilities of the individual - through a flexibly or individually organised curriculum.
Flexibility is necessary in order to "keep the pupil on course", cf. the discussion as to why many people leave the educational system prematurely or reap too little benefit from their schooling - also in cases where they do complete their education. The central factor in opening up of the teaching environment is the teachers and their attitudes to the enterprise of school, including its tasks and the criteria for evaluating quality, which are applied. The European community needs to develop a school where the frequency of drop-out and segregation is drastically reduced and where the individual competence of pupils is increased.

Indicator of an open innovative and inclusive school:

b) The teacher's personality and professional attitudes are the key factor for creating an innovative and inclusive school. These are the basic indicators of whether teachers will be able to implement the necessary changes in the curriculum.

In order to achieve this it is necessary for teachers through their thinking and teaching practices to, on the one hand, orient themselves towards the opening up of teaching environments, and, on the other hand, to anticipate criteria relating to competence and quality in the society of the future. The school head is a very important factor in this whole process. The attitude of the head teacher and backing towards the teachers in their reorganisation process will promote this development considerably.

Indicator of an open, innovative and inclusive school:

c) The professional attitudes of the head teacher are at least as decisive as those of the teachers, as it will be infinitely easier for teachers to renew their teaching if they receive the backing of the school administration.

A development of this kind can be achieved through the teachers' and administration's knowledge and experience, which an appropriate in-service training can help to build up. In-service training is therefore seen as a necessity in order to ensure and accelerate the development.

What competencies can students rightfully claim from their school?

ICT based technology is both the precondition for the changes in society and the lever that enables further development. It changes our everyday and working lives, and the pace is so high that we constantly need to adapt, take further training, and adjust our way of thinking in order to keep up with developments. This is also true about the schools and their teaching practices. Students can rightfully expect to become versed in ICT, learning to use a computer as a tool to learn more and communicate with others. Given the outlook for the future, students can rightfully expect to be strengthened and further developed on qualities that concern their personal development (i.e. exploitation of personal potential; ability to analyse specific situations; select and use information; forming personal opinions) and their individual and social development (i.e. respect for others; the ability to be member of a group; cooperativeness) because this will enable them to better meet the challenges posed by the society of tomorrow.

What are 'special needs' in an inclusive school?

Special needs will no longer be pre-definable by the school the way they used to be as a need with the student, meaning 'the gap between a norm and the student's current relative position'. In future, 'special needs' will express a certain characteristic of the challenges that must be addressed through education. These needs confront the teacher when he prepares his education plans in co-operation with the student - always based on the student's potential capacity and current competencies. 'Special needs' will pose a challenge when planning the actual education; education plans must seek to enhance (add to) the competencies inherent in all students (building on a positive foundation) rather than filling the 'gaps' that are so evident when the same situation is seen from a normative viewpoint (remedying deficiencies - building on a negative foundation).

In the years to come, ICT will make very significant tools available to students and teachers when special needs arise during education. Specially equipped 'work stations' will be available to students who need, for instance, to control their rate of speech; blow up on-screen information to facilitate reading while searching for electronic data; to order acoustic presentation of a written text; or electronic facilities to take notes during education, which will allow them to store information for subsequent printing, etc.

This paradigm will in the long run alter our view of the traditional interpretation of what constitutes a disability on the part of the pupils and their need for special educational provision.

How should this paradigm shift be handled in the education system?

The transition process can be supported through the use of IT - both during teacher post-training (Open and Distance Learning/ODL) and day-to-day teaching. In the light of the experiences with many years' work with ICT, Open and Distance Learning (ODL) and team working on electronic networks, it is safe to conclude that ICT and ODL represent tools and structures that are efficient and extremely well suited to open the teaching system and the individual institutions, influencing teaching practices to adopt an 'involving' approach to teaching based on co-operation between teachers, while focusing on the individual students' unused capacity, interests and competency development in a social context.

ICT helps to meet many of these challenges. For instance, it provides a means to:

- individualise learning;
- facilitate greater control by the learner;

- bring together learners (even when geographically distant) into learning networks;
- develop the quality of education through new pedagogical possibilities.

However, ICT also creates needs of its own, for instance it demands that we:

- acquire new skills to control and use equipment and software;
- learn to read for information in order to access knowledge (reading to learn);
- learn to work effectively with new genres (such as hypertext and Computer-conferencing);
- learn to select appropriate and reliable information from the vast range now available
- learn to deal with the 'internationalisation' of information, and with corresponding language and cultural barriers.

If pupils are to benefit, then teachers must first:

- become aware of the possibilities which ICT provides;
- acquire appropriate skills;
- experiment with new ways of teaching.

Experience from the SocraTESS ODL Project shows that Open and Distance Learning (ODL) can enable teachers to meet these challenges, because it can:

- give them first-hand experience of using networked computers;
- make them aware of international research and enable them to apply its findings to their own classrooms;
- enable them to join a learning network of teachers both within their own locality and across Europe, and to do so at times which suit the teacher or group of teachers;
- enable enthusiastic teachers to work with colleagues to improve their own schools.

Indicator of an open, innovative and inclusive school:

d) ICT competence is an important tool in creating flexibility in the curriculum (adapting the curriculum to the individual pupil and promoting collaboration between pupils). The teachers need this competence in order to glean professional inspiration and in order to advise pupils. The pupils need it in their individual, academic and social development.

The decision-takers, the central administration and research institutes

In order to achieve the above-mentioned development in the school administration and in the teacher team, it is necessary for the teachers to realise what is expected of them, and it is here that the initiatives taken by central bodies in the education system play a large role.

This involves in particular mediating expectations, visions, research findings etc., as one cannot just assume that the teachers will as a matter of course keep themselves posted with regard to the international literature and research on issues of school and related sociological perspectives. Teachers might find research findings rather inaccessible, because many of these are published in a foreign language, or because the format of the reports and the way they are presented seems confusing, or because it can be difficult for teachers to assess perspectives for daily teaching arising from the findings.

If one takes as an example the IEA survey on reading, it can be seen that the authorities and research institutes in some countries have done much in the way of "translating" the findings of the survey and indicating new pedagogical possibilities in school, and as a consequence of this one can also see changes in the teacher's pedagogical considerations and changes in the practice of the school. It thus appears that

reactions by the teachers to comparative international surveys are not expressed to any noticeable extent unless a dialogue is entered into between teachers and experts outside the individual schools.

Teachers' openness towards changes in their teaching practice It is of decisive importance that teachers prepare for changes and for carrying them out. The openness of European teachers towards changes in their teaching practice can be described as a continuum, which ranges from a very closed to a very open teacher profile. The "open" teacher will immediately be in a position to commence work on utilising the possibilities contained in the above-mentioned indicators, while a greater or lesser degree of inducement will be required before one can overcome resistance in teachers who occupy other positions in the continuum.

The teachers who occupy the "closed" end of the continuum can be characterised by the following:

- resistance towards ICT
- no, or only modest participation in in-service training courses
- no, or only modest participation in developmental tasks in school or within a broader forum
- resistance to teamwork in the school
- reluctance to share their teaching practice with others
- limitation of school/home co-operation to a minimum
- definition of "teaching" as one-way communication, teacher to pupil
- in favour of segregating to other forms of provision pupils who cannot keep up

These traits are not necessarily all present in the same teacher, but are mentioned as examples which can be used to describe teacher profiles.

Indicator of an open, innovative and inclusive school:

e) The teachers' teamwork helps to create a professional life, to get ideas to blossom and yield the energy needed to tackle tasks, as the benefits of a good teamwork will be greater than merely the sum of the individual team members' competence.

The teachers' teamwork can therefore be viewed as a very important lever in influencing resistance to changes in some teachers. Team formation and teamwork on an in-service training course are the fulcrum around which teachers with more closed profiles can be swung out of isolation, provided that the teams are put together so that both "open" and "closed" teacher profiles are represented.

The authors are all member of TESS Network http://tess.dk http://tess.dk/
Which is a European network of educational net workers.

CAUSES FOR THE IMPLEMENTATION OF A DIDACTIC INNOVATION IN THE ECOLOGICAL AND ENVIRONMENTAL EDUCATION

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Introduction

It was not until after ecologic disasters as for instance Serveso - Italy (1976); Bhopal - India (1984); Chernobyl - Ukraine (1986) that the world was made aware of how important both ecology and environmental protection for the contemporary man were. As a consequence some legal regulations to safeguard both a better control and safety were laid down, and authorities made up hastily for gaps in the eco-awareness of the societies – the gaps in the ecological and environmental education. It is usually so that nuisances relating to the environmental deterioration of land, waters, atmosphere affect societies not authorities (from the topmost to the local level). According to experiences of many countries, the most efficient manner to put an end to the environmental deterioration is to raise the society with environmental awareness, provided that any actions taken are effective and not for keeping up appearances. The UN Conference held in Rio de Janeiro (1992) provided communities with the right of settling matters on the environmental protection, and state governments were obligated to both facilitate and hasten the development of both awareness and commitment of a society through a free access to information, advice, court & administrative procedures. The governments shall incorporate citizens, school kids through adults, to their educational policies, irrespective of the activity of both non-governmental organisations (NGO) and modern institutions and establishments in the scope of the environmental protection.

Innovations in education

Due to the existence of a great demand for innovativeness in every sector relating directly or indirectly to the organisation of teaching both ecology and environmental protection, the search for appropriate patterns has been commenced. More and more often we come across a practical implementation of what is put forward by theory in terms of innovative solutions. The desire to implement the latter should be preceded by the control of their merits to be certain of their usefulness upon implementation. Such a control is carried out by i.a. different experiments. The attained results are supposed to indicate the appropriateness of the said solutions in practice.
It is the development of "nature-related" education which is to be pursued so that it is treated as a priority while conceptualising and implementing teaching programmes, and in particular when the accessing stage is under way, and later on once the presence within the European Union is a fact.

With respect to matters of urgency i.a. the following items may be well specified:

- hooking-up the preliminary (and higher) level schools to Internet
- establishment and development of both "nature-related" theme labs and libraries
- hastening and upgrading measures for further education of teachers of "nature-related" subjects
- putting forward such teaching methods in conjunction with appropriate both team-work schemes and experiments to be carried out by schoolchildren, as to render the latter more active
- provision of linking networks (tv, IT) between European schools (co-operation in designing programme solutions) and institutions for informal education, and particularly NGO
- transfer of teaching programme patterns for school networks (preliminary schools, colleges, universities).

In Poland an innovative approach to teaching natural sciences is connected with an integrated teaching model. The innovativeness consists in the use of video films relating to field work where the participants record by means of a camera more interesting natural phenomena they spot. At a later stage they analyse

such a field work and draw conclusions. The development of engineering and technology via the introduction of computers (Internet, video, etc.) to the school in terms of teaching natural sciences have enabled the school kids to make use of the following conveniences:

- creation of databases with information required for both observation and experiment
- application of didactic games (along with both simulation and modelling of real situations)
- development, check and assessment of tests on teaching results.

The ecological & environmental education, its forms and ways for its realisation are all an innovation which everybody may verify empirically.

Upon carrying out the works and research their results are successful, the evidence here being:

- ecologic schools with their programmes (the so-called green schools)
- ecologic classes with their individual programmes
- ecological vacation colonies
- ecologic camps
- environmental protection summer schools
- ecologic centres
- field laboratories
- didactic "nature-bound" pathways
- botanical gardens at schools
- NGO activity and particularly pro-ecologic youth movements.

These innovations encompass all the levels of both education and raising methods in line with the motto: "To live in harmony with nature...".

At the ecologic schools the teaching in connected with the establishment of the so-called "green classes". In time, the platform between such a green class and environment constitutes a preparation stage for field work, observation of nature and its preservation.

In pursuing field activities both the theory and practice are to be reconciled. It is the term of he field activities when the schoolchild works in a direct contact with nature.

The task of the ecologic schools (and not only of these) is to built up environmental awareness which is to embody the ecological culture it means the attainment of:

- ability to notice phenomena in nature
- ability to logical thinking assuring a guarantee for ecological safety
- ability to be responsible for environmental protection
- some knowledge on environment
- ethically favourable conduct.

The actual components of the said ecologic culture may be assimilated only while performing field tasks. Working in the field enables to comprehend environmental problems and to attain monitoring abilities at a local level through:

- distinguishing between manor and major features
- doing the best of the knowledge acquired under diverse circumstances in the field

- a habit of monitoring environment in an immediate vicinity (locally)
- result assessment
- drawing proper conclusions for future to come and a reference to a global level.

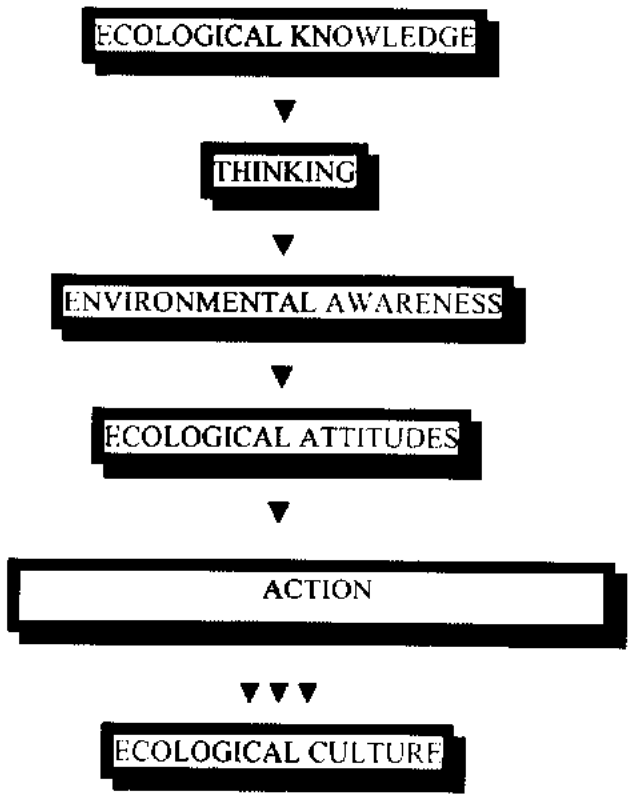
The field activities make the participants develop the following skills:

- field observation
- data collection
- grouping and analysing the collected research specimens
- comparing
- differentiation
- formulation of hypotheses
- concluding
- forecasting
- search for the possibilities of problem solving and prediction of effects of decisions taken.

The conduct of field activities enables to embody the following attitudes:

- sensation of moral responsibility for the environmental quality
- readiness to take part in any activities aimed at both environmental protection and improvement
- appreciation of the others' rights and values that relate to man's activities in environment
- provision of the participants with a judgement system to enable them an environmental assessment.

Proved correct and proposed model of innovation in ecological and environmental education



The top priority of the ecological education is giving shape to both the ecological awareness and culture. The education may be well realised along some programme pathways in teaching at the D-care, primary school, college, university and post graduate courses levels. The environmental awareness, induced early enough and then duly cultivated in the youth, enables to create a society of mature persons with aware and accepted, and even selected profound ecological culture where the preservation of nature at local, regional and global levels is not going to be a whim of politicians.

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SCHOOL DEVELOPMENT IN A SWEDISH MUNICIPALITY
A LONG AND WINDING ROAD

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Introduction

The Swedish government has declared its positive attitude towards educational use of ICT[1] in its communication with the title "Tools for Learning – a national programme for IT at school"[2]. The Swedish minister of education wishes to "give yet another tool in the hands of the teachers and students in the country" by investing 400 million SEK in school development purposes (27 projects in total) within the area of ICT.

The Government is of the opinion that ICT is a necessity that will open the classroom towards the outside world (internationalisation), facilitates and supports writing, stimulates the senses, paves way for new forms of work in school. Besides, the government sees the knowledge of ICT as necessary for every citizen in the future world.

Technology optimism is obvious in the discourse of the government: the new technology is seen as a tool for renewal in pedagogy, even a tool for democracy. However, the ideas are vaguely formed and the coupling to the concrete everyday work in schools is missing which reflects even in the development projects on school level.

The purpose of this paper is to shed light on the school development work in general through an example of a three-year project carried out in a Swedish municipality with financing from the Competence and Knowledge Foundation[3]. The focus of analysis lies in the processes and factors that steer the development work in an organisation like school.

The ICT project on Gotland

One of the 27 school development projects was situated on Gotland. The municipality of Gotland is an island with around 58 000 inhabitants. Economy is based on agriculture and tourism. Concerning ICT, Gotland is one of the top five municipalities in the whole of Sweden.

The municipality of Gotland gathered 14 minor ICT projects in schools around the island under a common umbrella that consists of a programme for competence development for teachers. The project started in the autumn of 1997 and was finished in the fall of 1999. The competence development of teachers is to continue two more years. Governmental part of the financing of the project was 15 million SEK and the municipality pledged itself to contribute with an equal amount.

Gott-IT-land[4], as the municipal project was called, had as its overall goals:

- **An active student**; in accordance with the constructivist ideas, the student is seen as an active seeker and constructor of knowledge with the responsibility for own personal learning and development
- **A changed role of the teacher**; teacher is assuming a new role of a guide and tutor
- **Internationalisation**; projects aim to increase students' awareness of their own cultural heritage and that of others through frequent contacts with students in other countries

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[1] ICT= Information and Communication Technologies

[2] "Lärandets verktyg - nationellt program för IT i skolan. Regeringens skrivelse 1997/98:176.

[3] KK-stiftelsen in Swedish.

[4] "Good IT country", translation from Swedish.

- **Library as a pedagogical resource**: library is seen as the heart of the school with enhanced possibilities to information retrieval through ICT
- **Quality and efficiency**: meaningful use of resources, frequent use of ICT, high user participation, good working environment, ecological consciousness, interaction with the surrounding society are seen as factors that support quality and efficiency

Projects represented five different themes: competence development for teachers, IT in the new student and teacher role, language - internationalisation, student support, preparations for the future.

During a five-year period, all the school personnel were to participate in courses about ICT and workteam methodology. As a result of the training personnel should be able to work in teams and use ICT as a pedagogical tool.

The Gott-IT-land project was to bring resources, both material and competence wise, to the schools. Thus the pedagogy could be developed in order to meet the needs of the next millennium and to provide the students with the knowledge of the technology of the future so that they would be able to live in the global village.

The evaluation of the project was done continuously during the project time and in a formative manner. Feedback was given along the way in order to secure the right course and give new thoughts to develop the process in the projects.

Evaluation was conducted through interviews, participant observation and document analysis. An important part of the evaluation was the self-evaluations done by the project participants themselves. Traditionally, schools do not have the habit of self-evaluation. It is, however, important for an organisation to reflect upon the work that is done in order to be able to learn from the mistakes and to grow the awareness of the common ideology and of goals that should guide the every day work.

Theoretical Framework for the Evaluation

The evaluation work has been based on three aspects:

- Main question: How is the project carried out?
- Basis for interpretation against which the project results are being judged
- Theoretical frame of reference

Factors like **interpretation, communication**, and **responsibility** hold a key position in development/change work. Interpretation of the purpose and goals of the project is of vital importance to the success of a project as well as the efficient communication of these between the different organisational levels, between individuals, and between different parts of the project. Functional and clear delegation of responsibilities within the project is also critical to the success of it.

Development and change can be monitored on different arenas as well as the communication and responsibilities between arenas. There can be distinguished a formulation arena which gives the purpose and goals; accomplishing arena realises the purpose and goals given by the formulation arena. There may also exist a reformulation arena that reformulates or interprets the original purpose and goals.

The third perspective is about the possibilities to the concrete accomplishment of a reform work. These describe the process from an idea to action.

Idea - Initiative - Information - Implementation - Internalisation

Fourth perspective is the school code that effects the possibilities to carry out change. The school code consists of the values about education particularly, strategies of leadership, problem solving, means and methods of development. School code is also defined through the relations between people and levels as

well as through the decision structures/power structures and task structures – how work is distributed between leadership, teachers, and students. Communication between these groups is of interest in evaluation context.

Findings

In the following, our main findings are presented chronologically.

Year 1

The first year of the project was characterised by great enthusiasm and high ambitions among the participating teachers and students. The general ICT boom in the society made it attractive to introduce the technology in schools as well. The vague goal formulations within the small projects and difficulties in interpreting the overall project goals obstructed the project work.

Technology problems consisted mainly of Internet accessibility. The infrastructure was under construction and the planned project activities (like e-mail contacts with other schools) were delayed. The pedagogical discussions were modest at this stage and concentrated on the spatial organisation of ICT resources: schools had built special computer rooms which classes visited when they had computers on the schedule. Now it became obvious that it might be both effective and practical to spread the resources over the school premises in order to increase access. Both teachers and students could use the technology when they needed it as machines were in every classroom or in the close vicinity in stead of locked special rooms that had to be booked beforehand. Organisationally, it soon became apparent that the division between local and central responsibility within the project was not clear to all parties, which again made the work difficult.

Year 2

After the initial difficulties, the majority of the small projects made considerable progress towards the overall project goals despite the lack of conscious development strategies among the school leaders. ICT training was realised according to the plans although the IT-pedagogues were working under enormous pressure. They were simply too few from the beginning and, besides, the demand of training and everyday support from the teachers grew steadily, as ICT became more common and use increased. ICT training consisted mainly of learning to use various software products. Pedagogical discussions were scarce. Both accesses to the machines and to the Internet were improved.

The second year of the project also witnessed the gradual spatial and organisational dissolution of the traditional classroom. Other constellations were tested. A group of teachers would jointly be responsible for a certain group of students. Working constellations would vary depending on the project or task at hand. The guiding role of the teachers became more and more visible.

The realisation of the project goals was still difficult and it was obvious that the pedagogical personnel should be more active and carry out their own interpretation of the goals in order to make them concrete. We could also observe that the leadership of the training was lacking a clear vision about how computer and work team could be used as pedagogical tools. Their leadership was vague and may have had a slowing effect on the pedagogical and professional development.

Documentation and evaluation of the processes were still problematic within the project despite our efforts to encourage self-evaluation.

As the time passed, it also became clearer that the project work should be tightly integrated into the everyday activities of schools so that the efforts would have a more permanent role and live on even after the project itself was over.

Year 3

The third year of the project witnessed an ever-growing use of the computers and the Internet by both teachers and students. The pedagogical experimentation remained modest as most of the technology use centred around word processing, various training programmes, and information search. Most of the

students used computers 1-3 hours per week, which does not sound particularly much. We may assume that the students involved in the projects did use computers more extensively.

The communicative use of the technology became popular among the students as they discovered the possibilities of the chat functionality. Eventual pedagogical gain of the chatting seemed minimal to the teachers but the excessive and even harsh chat behaviour led to important ethical discussions in schools.

Ethical issues became, perhaps unexpectedly, dominant in the project. As the use of the computers and the Internet increased students discovered that they were entering a new, unregulated zone where the boundaries of the habitual behaviour could be tested. Sabotage and damage were usual. Teachers were unprepared and the first reaction was suspension of those who misbehaved themselves. It soon became obvious that student participation was more effective a way to stop the negative trend. In many of the schools the students became involved in the organisation of the everyday ICT use. They also took part in the formulation of the ICT rules.

Teamwork training was still fumbling and unstructured in the most cases. School leaders were often uncertain and invisible in the development process.

We mean that even school leaders should reflect upon their role in the development work. They should dare to challenge the personnel and thus help them to reflect more upon their own work and practice as well. It is important to contemplate on how the training supports development and change, and what does the so-called digital competence consist of.

We would also notice that after three years of training in self-evaluation it was still problematic for the most teachers to carry out evaluations of their own.

Conclusions

In our evaluation work, we have tried to anchor the empirical findings to the existing theories on school development. A central part in evaluation work has been to continuously inform the field about our findings and the theoretical couplings.

We noted that our observations of the development on the field were consistent with the theories we consulted.

Despite the informative efforts from our part, it seems that the process of development is time consuming. It cannot be hurried and there are no short cuts. The process from information, through insight to actual change in practice has to take its own course and phase. It is also a process on different levels: individual, group, school, municipal, national; levels that are not necessarily in concert with one another from the beginning but have to be given time to reach harmony through active cohesion work on and between all levels.

Our understanding is that the role of the school leader is vitally important in development projects that are initiated top-down – as was the case on Gotland. A strong leadership that can mediate the goals coming from above and translate them to the local situation and convince the personnel of the necessity of the realisation of these goals is one of the key determinants when it comes to the success and failure of a development project.

The three years of development work on Gotland have resulted in some noticeable changes in the participating schools. We may see that some of the project schools have managed to realise the goals of the project when it comes to the roles of students and teachers. The teaching is more individualised and based on the needs of each student. Teachers act as coaches and plan the different activities together with the students. A major concrete achievement of the project is that the ICT infrastructure has been built during this time and that there now exists a functioning platform for future development. It is only now that the pedagogical discussions about ITC's role in schools can seriously start and further possibilities of ICT can be explored.

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THE INTERNET: TRAINING TOOL AND TEACHING AID

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The UOC context: Multimedia and Communication

The Internet is where we can find information, communicate with other individuals and groups, and publish materials that help people to learn. The network overcomes the barriers of space and time, and greatly expands the quantity of resources that can be offered and found.

The Open University of Catalonia (UOC) brings to the current university system a new way of understanding both the teaching-learning process and the concept of what a university is, since the two dimensions that are normally employed in the definition of an activity, time and space, have a different meaning at the UOC.

Study and learning with temporal and spatial co-ordinates that are different from the conventional ones, that is to say studying asynchronically, is made possible by:

- the improvement in the tools and systems of telematic communication
- the development of virtual learning environments
- the design of new pedagogical approaches and resources
- the implementation of new ways of managing information and education.

The UOC virtual campus is designed in such a way that one can find the same range of services and assistance that you would find on a conventional campus, but in addition it is always open 24 hours a day and is thus accessible at all times and from wherever you are.

The UOC virtual campus is an intranet with a pedagogical purpose which facilitates the fundamental needs of distance learning: asynchrony, the central role of the student, and collaboration.

This means that the virtual campus provides the students at the UOC with an environment where they can carry out their studies. It is thus an example of the resources that the Internet provides for educational purposes. If you are a student at the UOC, you have daily experience of the possibilities that are offered by the technologies of information and communication (TIC) in the learning process. The students who are beginners in the use of the Internet and the UOC virtual campus need gradually to learn and appreciate that information is available on the network and that they need specific learning strategies to study in this new environment.

With the philosophy of maximising the educational possibilities of these new technologies, the Open University of Catalonia began, five years ago, by designing its subject in Multimedia and Communication at the UOC. Since then this subject has constantly evolved and innovated in line with the technological changes of the so-called Information and Knowledge Society.

Multimedia and Communication is a transversal and compulsory subject at the UOC; its aim is to prepare students for their University studies and to "homogeneize" the different styles and approaches that the students bring with them (Guitert, M. 2000)

The aim is that, by working through this subject, the students gain an appreciation of what is needed to study in a virtual environment and in an open and distance university, where they themselves are responsible for their learning process. At the same time, the subject provides the students with a model for the study of the other subjects at the University and they gain experience in the use of the different learning tools and resources.

The general aims of the subject can be grouped into three blocks:

- To learn the strategies that are needed to study in a virtual learning environment like the virtual campus
- To consider the roles of the information and knowledge technologies in the Information Society
- To improve and expand the basic computer skills that are required by students at the UOC.

These aims are realised in the following contents:

- The world beyond the Virtual Campus and learning strategies in virtual environments.
- Information and communication technologies and their impact in different ambits: social, political, economic, cultural, educational, etc.
- The basic tools at the UOC: tools for text-processing, presentation, and for the management and handling of data.
- Specific tools:
    - Excel for economics and business, *Business Studies and the Business Administration and Management*
    - Basic html language for web page design, *Humanities*
    - Introduction to the world of multimedia, *Computer Studies*
    - Introduction to Access data bases, *Documentation Studies*
    - Legal data bases, *Law*
    - Internet resources for education, *Educational Psychology*

Multimedia and Communication is a subject that consists of 4.5 credits, one of which is specific to each degree course. In the case of the students of Educational Psychology, (most of whom are primary and secondary school teachers), this specific credit is devoted to the study of the possibilities that the Internet has for education, in other words to present the Internet as a tool for the teacher but also as a teaching resource. The material that is presented, "Internet Educational Resources", is full of tools that non-university teachers need in order to use the Internet in education, and it has two aspects: social interaction and interaction with contents.

Internet educational resources material

The material is in web format and serves as a model of a network resource in that it offers a range of possibilities for the use of this tool in education. In consists of three blocks:

Introduction. The possibilities of social interaction focussed on learning combined with the interaction with learning contents make the Internet a much more powerful medium than any other.
Resources. The quantity and variety of the educational resources that can be found on the World Wide Web is enormous and is constantly on the increase.
Design and creation of an educational web site.

In the first block, when we refer to the Internet it its relation to education, we are talking about the interaction with contents and the social interaction with other people. The ultimate aim of these interactions is the construction of knowledge.

In the so-called Information Society, the acquisition of the habitual use of Internet services which allow interaction with other people (email, forums, chats, etc.) needs to be considered as a learning content that the teacher needs to deal with. As for the interaction with contents, in other words the search for, the collection and the organisation of information on the World Wide Web, this requires a training for the teachers so that they can handle tools and strategies to overcome problems such as: excess of information,